THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE MINERS' FALLACY.

IT is a little difficult to understand in these days of education and enlightenment how such foolish proposals as the recent decision of the Scottish miners to work only four days per week can be really seriously considered. Or is it that education is not carried far enough, and that the true explanation lies in the fact that "a little learning is a dangerous thing?" We are inclined to this belief, as it is the miner's idea that when prices fall it is solely due to the supply exceeding the demand; this is true to some extent, but there are other factors which enter into the complexity of declining trade and affect the question. The demand may still exist, but at reduced prices, and so long as buyers can get coal at prices which they can afford to give, they will continue to order, and the pits may be kept in full swing. But it is to be noted that lower prices apply not only to the coal trade but to every industry, and the lowering of prices is due to the desire to keep the volume of trade the same. Hence one often hears the expression "Yes, we are busy, but prices are not so good," and if wages are to remain the same, it follows that profits must be reduced. This is what really does happen, often in fact, until instead of profit there is actually a loss; then it becomes necessary, if the works are to be kept going, for the employer to ask the workman to bear his share by accepting lower wages, and this is what the Scottish coalmasters are at present demanding, in order to keep the pits open.

The Scotch miner, however, thinks he can alter all this by simply reducing the output, and he decides to work only four days per week instead of six, so that by limiting the supply the owners will get better prices and his rate of wages will remain the same. But the strange part of the matter is that he entirely ignores the reduced total earnings for the whole week. Thus, if his present rate is 7s. per day, and he works four days, his earnings are 28s., but if he accepts the reduction and gets, say, only 6s. per day, his earnings for six days' work will be 36s. The public, we believe, have always been more or less sympathetically inclined towards the miner, but we doubt whether they will have the same consideration for men who wilfully refuse to work, and who would rather do with a less amount of wages than do their usual work at a reduced rate, but for a greater total. What about all the harrowing tales of the high rate of living and the hardship and poverty of the miners? There never was any real poverty, and, as a matter of fact, there never is, in any mining village. Improvidence there may be, but there is no poverty due to lack of work, except when the men absolutely refuse to work. Evidently the miners have no real complaint to put before the public of the smallness of the living wage.

This, however, is not all, because even if the pits only worked four days per week, this fact would not maintain prices. Buyers would simply go to other districts, and the result would be the diversion of the trade, possibly to such an extent that it would be difficult for the owners to maintain sufficient trade, even at the lower prices, to keep the pits going three days a week; and once trade is gone, it is very difficult to get it back.

The owners naturally propose to resist the attempt of the men to reduce the number of working days, even to the extent of closing down all their pits and locking out the men. As a matter of fact, this is not so much a policy of spite as of economy. The "on-cost" and establishment charges of a colliery can only be covered by a certain out-

put, which is more or less constant, for if prices are high the charges are higher, and if prices are low the charges are lower. The men, therefore, by their action would reduce the output to such an extent that even if prices remained high there would probably still be a loss instead of a profit; but the masters know only too well that the men's proposal would not result in maintaining prices, and they would not only lose by working the pits four days a week, but they would eventually lose all their trade as well. It would, therefore, be cheaper to close down the mines rather than keep them open on a greatly restricted output. One would think that the labour leaders—who, we suppose, are not entirely devoid of intelligence—would know this and would, therefore, counsel the men otherwise. Or is it that they are afraid to tell their followers the truth?

At a colliery in Cumberland the men, numbering about 300, have been asked to increase the output and submit to a reduction of 10 per cent., or the pit will have to be closed. The Council of the Cumberland Miners' Association has advised the men not to submit to any reduction, so we may assume that the pit will be closed and 300 or more men thrown out of employment in a district were there already exists much distress owing to the recent closing of another colliery.

Some time ago we pointed out that the true effect of the minimum wage would not be felt until trade began to decline and prices began to fall, compelling the masters to ask for reductions in wages. The National Federation of Miners have fixed the minimum wage at 7s. 6d., but the Scottish coal masters have asked for and been awarded a reduction which has brought the wages below this amount, viz., 7s. 3d., and they are now asking for a further reduction. Undoubtedly this will be followed by demands by the owners for reductions in other districts, which we suppose will be resisted by the men, and, on the whole, if the firebrands are allowed to have all their own way the new triple alliance of miners, railway men, and transport workers may have an opportunity of showing its strength; but it cannot possibly alter the fact that any article, even if it be coal, will only sell for what it will fetch, and that the workman can only obtain a portion of this price and not the whole of it.

BRITISH TRADE IN CANADA.

The annual report on the trade of Canada prepared by Mr. C. Hamilton Wickes, H.M. Trade Commissioner in that Dominion, and just published by the Board of Trade, contains some interesting notes on the position of British trade in Canada and some valuable hints as to how it may be improved. By a painstaking analysis of the statistics Mr. Wickes is able to show that the value of the market to British trade is not nearly so great as is generally supposed. The total imports in the year reviewed, viz., the 12 months ended March, 1913, according to the statistics, amounted to £135,960,000, but of this amount he has ascertained that £47,040,000 consisted of goods which must for natural reasons be supplied by countries other than the United Kingdom (chiefly the United States), while a further amount of £12,920,000 represents goods such as raw products, which, though they may be supplied by British merchants, are of no interest to British manufacturers. The remainder, £76,000,000, or only 55·8 per cent. of the total, consists of goods in the supply of which British manufacturers may hope to compete.

Of this amount we actually supply only £25,000,000. Taking all things into consideration, this is by no means an unimportant share, but Mr. Wickes finds that as 85·3 per cent. of these imports from the United Kingdom are granted a preference, and as the fact that we get even this amount of trade may fairly be said to be due to the existence of the preferential tariff, the "position revealed is disquieting." He is of opinion, moreover, that our obtaining even this amount of trade is due rather to the efforts of Canadian buyers in finding out British sellers in order to obtain the advantage of the preference, than to the efforts of British sellers in working the market. All of which is not at all inspiring. Nevertheless, Mr. Wickes admits that serious attempts are now being made by British traders to acquire information as to the conditions existing on the market, and to study how best to market their goods; a further note of hope is struck when he points out that the outlook for an increasing share in Canada's trade being obtained by British manufacturers appears to be promising, having in mind that in addition to the re-awakening of British interest just referred to, that of Canadian firms desiring to be put into touch with British sources of supply is no less remarkable.

Some of the chief reasons why American firms have succeeded in Canada in competition with British were given in last year's report, to which we called attention when it was issued. Mr. Wickes now gives a list of some of the most important points which have been suggested to him on the spot as being necessary to be observed by British firms. Some of these are old suggestions, which are nevertheless of great importance, such as the need for carefully choosing agents (about which many even of our leading firms are singularly careless), the preparation of catalogues in Canadian currency, the proper supply of samples, the need for considering the point of view of the agent as expressed in his correspondence, and a better knowledge of terms of credit. Two other suggestions may be specially emphasised, however, viz., that more attention should be paid to the price at which goods are retailed, and that manufacturers should take the trouble to understand the geographical features of the country. As to the former, it is only too rarely realised that a prime factor in trade is the price at which the goods are finally sold to the consumer: the manufacturer often takes little or no care to keep a check on this price in order to maintain his trade. As to the latter, it may be pointed out again that Canadians are very jealous of the importance of their country, and a lack of knowledge of the existing conditions which is often displayed by firms with which they deal, often has the effect of seriously wounding their susceptibilities.

Dealing with the question of the amount of labour forced upon the agent by quotations in sterling and by constantly changing discounts, Mr. Wickes points out that want of care and consideration in these and other comparatively minor details concerned with the marketing of goods, seriously impedes the development of British trade in Canada. It loses the British manufacturers order after order from the Canadian trade. He adds, "from intimate touch with those acting as agents, we have learned that the same reasons seriously affect their attitude towards British agencies. The more important class of agents, who can pick and choose agencies, will only accept those which give an adequate profit with the smallest amount of clerical labour, consequently their first attitude towards British agencies offered to them is one of doubt."

In addition to general advice to traders, the report contains specific information regarding the trade in particular classes of goods with very exhaustive statistics showing the extent of British and American trade in each line. We shall give next week some extracts from the report, but we would suggest that those of our readers who are interested in trade in Canada should obtain a copy for themselves. For a variety of reasons, some of which are perhaps unavoidable, our electrical business in Canada is none too prosperous. From time to time we have referred to some of these causes at length, and we need not enlarge on them now. That the trade could be substantially increased there can be no doubt, and the report now before us will assist to that end if the suggestions therein made are carefully followed up.

A New Type of Gas Engine.

On another page we print a description of the Fullagar internal combustion engine which was on demonstration at Newcastle last week at the joint meeting of the Institution of Naval Architects and other engineers. It appears that in its cycle of gas operations there is nothing new. It is a two-stroke engine of a quite usual type. Its novelty is purely on its mechanical side. Engineers have for nearly

two centuries been accustomed to regard the connecting rod, with its very considerably oblique action, with equanimity. In fact, the connecting rod—a strut of two rounded ends—vibrating violently across its longitudinal centre line has been, so to say, taken unquestioningly to our hearts. Why, then, should we seek now to question the oblique side rods of the Fullagar engine? They are less oblique than even very long connecting rods, they are by way of being very square ended indeed, and they are always in tension, and have an inertia bending movement of very trivial intensity. We see no reason whatever why a piston in one cylinder should not be thus connected to a piston in another cylinder for the purpose and with the object explained. And that object is one for which even much of less merit than those oblique rods might be permitted in construction. For it is no less than the return of the engine shaft to its proper condition of a piece stressed in one direction only.

In no part of an engine do reversed stresses play a less desirable part than in the crankshaft. They render imperative a much greater diameter, and they thereby largely increase the friction load of the engine. It is well to abolish this friction in company with much excessive weight and cost and space, if it can be done by the simple connections described. Of course, if to one piston in four happens a misfortune, even though it be a very small one, the whole four pistons of an element of the engine are put out of work. But does not this practically apply to any engine? Obviously this new engine has been run so long that there are no qualms as to showing it, quiet as it has been kept during its probationary period. We feel that it has come to stay, and, since its mechanical construction can be applied to the two-stroke Diesel cycle, there is a wide field for it. It enables four very simple cylinders to be combined in one two-cylinder element, and thus by keeping to moderate cylinder diameters an enormous weight is saved in any engine of a given power.

Vexatious Inquiries.

In the event of the Revenue Bill of this year receiving the Royal Assent, all owners and occupiers of land and buildings will be required to furnish information with a view to dividing the rateable value of land so as to distinguish between the values attributable and not attributable to houses, buildings or other improvements. This is required in order that the full site values obtained under the Finance (1909-10) Act, 1910, may be adjusted for each separate assessment for local rating purposes.

Although trading and manufacturing firms *per se* do not greatly concern themselves with legislation, the Land Union points out in a memorandum just issued that this proposal will seriously affect them, as the information, demanded under penalty, will be most difficult and costly, if not impossible to furnish, and will include much confidential detail as to profits and working expenses, apparently to be utilised as a basis of rate assessments open to inspection by other ratepayers and by the public.

Amongst other details asked for are particulars of all outgoings and by whom borne, any adverse or beneficial rights, easements or covenants, and any improvements in buildings, plant, and machinery not incurred more than 50 years before the date of record. In the case of tramways, details of car-miles run, receipts from each separate service, working expenses, running powers, and working agreements are required, whilst electricity undertakings must furnish particulars of receipts and working expenses.

We neither support nor object to the Bill on political grounds, but solely as a matter of business we advise our readers to consider carefully the proposals of the Government in order that they may approach their Member of Parliament or take such steps as they may think advisable in organising concerted opposition. Whatever is done must be done without delay.

For ourselves, we think that those who are engaged in the electrical industry are in these days compelled to spend far too much time in compiling returns and furnishing estimates and valuations, in some cases, we are afraid, solely to satisfy a policy which is to a large extent one of theory only.

Lead.

The position of the lead market, while rather variable, continues on the whole to be fairly satisfactory. There have since last writing been occasional spells of comparative ease, but these have only again given place to renewed firmness and activity due to the covering of oversold commitments. Towards the end of June, owing to the more abundant offers of near metal, and to the fact that immediate demands had subsided, there was an easier tendency, there being, too, more lead coming forward, but while the decline was continued into the present month when June prompts sold down to £19 5s., there was again a tightening up of the reins when deliveries had to be cleared up for the end of June, and as much as £19 15s. was paid by the bears, who never seem to learn the lesson. On the whole it may be said that lead is beginning to come forward with more freedom than for some time, but in spite of this everything coming along is wanted. What the trade earnestly desires is greater uniformity in the arrivals. At present, and for a long time past, metal has been reaching here with considerable irregularity, and the result has been widely fluctuating prices. These tend to create an uncomfortable feeling, and to produce an impression among producers that there is some unnatural interference going on with the regular despatch of lead from producing centres.

A notable feature in the market for some weeks past has been the selling of non-convention metal. Very fair quantities of American lead have thus been sold, both to the London market and to the provinces, while, what is still more strange, German lead from Hamburg works has been imported into London and utilised for deliveries against open market contracts. As long as the London price is in the neighbourhood of £19 10s., it is to be expected that United States lead will be sold to Europe. This is a price which, under existing conditions, pays the Americans very well, and there is a fair quantity of lead to come forward still against old contracts. The market, however, to all appearance, wants all the metal arriving, and the sales of American and German material have merely served to relax very slightly the more acute tendencies of the market.

There is a good deal expected from the reported resumption of operations at the Mexican lead smelters, but really very little definite is known. That the big smelter owners in Mexico—the American Smelting and Refining Co.—have made a fresh start at their Chihuahua plant is believed to be the case, but nothing positive is known except that instructions have been given by the owners for the resumption, and that the labour force has been despatched there. The railway service is still very bad, however, owing to the rolling stock being required for military purposes, and it may take time for operations to be resumed fully. When the railway system is at work smoothly, however, and communications are facilitated, other smelters will be put to work, and as nearly as may be, full production resumed.

The Villa interests are understood to be very favourably disposed to the resumption of industrial operations throughout Mexico, and the American Smelting and Refining Co. admit that under the Villa *régime* they received greater transport facilities that ever before. There is no doubt that Villa is influenced by the taxes payable by the owners of active plants, which he is anxious to receive for payment of troops, &c., and he is likely in consequence to be actively friendly towards corporations recommencing operations. Under the most favourable conditions, however, it must take some months before the American and European lead markets derive any tangible benefits from the commencement of mining and smelting operations at the recently idle Mexican properties.

The German Cable-Makers' Syndicate.

A matter of international importance at the present time relates to the likelihood or improbability of the renewal of the German Cable-Makers' Syndicate, whose existing five years' agreement will nominally expire with the end of this year. Having regard to this fact,

negotiations have been in progress for some time past with the object of securing a prolongation of the combination, but it has so far been impossible to reach an understanding, partly in consequence of the increased allotments or share in the trade claimed by certain of the constituent works, which have consequently given notice of withdrawal from the syndicate. As a general rule, notices are usually given in connection with syndicates as a formal matter, in order that a fresh division of the trade concerned may be effected under conditions whereby some firms hope to improve their position by gaining an increased share in the growing demand. In the case of the cable syndicate, the question of notices is considered to imply more than a formal procedure, as other factors have to be taken into account which render the renewal somewhat difficult. The first is that the cable factory Wahlen, of Cologne, which belongs to the Brown-Boveri group, will be brought into operation shortly, and will require a share in the trade; and secondly, the syndicate is feeling the severe competition of a Belgian company—the Constructions Electriques de Charleroi—and of British, Italian and other cable makers, the result being that prices in international markets have largely declined. Nevertheless, the hope is entertained in German cable-making circles that it will yet be possible to reconstitute the syndicate so as to avoid a return of the difficult times which occurred in 1908-9, when, owing to the advent of fresh competition, the syndicate was dissolved.

Electrical Accidents.

The report of Mr. G. Scott Ram on electrical accidents is always interesting, not only on account of the personal application which it possesses for so many of us, but also because of the interest which attaches to the details of the accidents themselves; we are therefore reproducing it almost *in extenso* elsewhere. We are glad to note that in spite of the constant increase in the use of electricity, the number of mishaps in electrical stations was no greater last year than it was five years ago, and there were only three fatalities, apart from non-electrical accidents. As usual, the switchboard was the scene of the great majority of accidents, a fact which fully justifies the attention given by the Home Office Inspector to this part of the plant; and, again as usual, many of the accidents might, and should, have been prevented by proper care and foresight, which are not always exercised even by experienced engineers. A singular case was that in which a coil of wire curling round a doorway made contact with live metal in another room; and it is surprising that engineers should attempt to handle live oil switches, as they did in three instances.

Unfortunately, there was a serious increase in accidents in factories, with no fewer than 17 fatalities, and the Inspector points out that many of these were due to the lack of skilled supervision, while others were caused by apparatus of faulty design or manufacture, and by disregard of the Home Office Regulations. The electric furnace appears this year in the list for the first time, we believe, a man being severely injured with a pressure of only 60 volts alternating. The accident to a labourer who managed to reach over a screen 6½ ft. high in order to brush high-pressure apparatus, with which he had no concern, while it shows excess of zeal, also indicates that the most careful precautions are unavailing to keep some people out of trouble. Falls from cranes and other elevated apparatus due to shocks occur with regrettable frequency, and very often with fatal results.

A disturbing feature of the latter portion of the report is the evidence of careless design on the part of the engineers responsible for the lay-out of plant. Narrow passages alongside of live metal, oil switches connected to bus-bars without isolating switches, and dangerous fuseboards, are mentioned; we note that one three-phase installation at 440 volts, "put up by a foreign firm of contractors, was dangerous in almost every conceivable way." We are glad to learn, however, that in many stations and works attention to safety has been the first consideration, and many supply engineers are taking pains to see that their consumers' apparatus is in accordance with the requirements. Of the 20 fatalities due to electricity reported last year, no fewer than 12 occurred through shock from low-pressure systems (not exceeding 250 volts).

ELECTRIC MAINS EXPLOSIONS.

We mentioned last week that the Committee's report on electric mains explosions was accompanied by two appendices, and these call for some comment. The first comprises a report addressed to the Secretary of the Explosions in Mines Committee, containing the results of an experimental investigation carried out by Mr. R. V. Wheeler at the Home Office experimental station at Eskmeals, on bitumen gas explosions, and of great value and interest. It is wholly directed to the subject on which the Committee was instructed to report, and it gives definite information on points concerning which everyone having had practical experience of these explosions was hazy.

The Second Appendix contains the reports of the electrical adviser to the Board of Trade on six explosions investigated by him and made at the time of his examination into the respective occurrences.

Samples of the following materials were submitted to Mr. Wheeler for examination:—(1) "Callender" bitumen; (2) "New" bitumen; (3) Callender-Webber casing; (4) Glasgow pitch; (5) Pitch and whinstone dust composition. Three specific questions were put:—

1. Whether spontaneous ignition of finely-divided carbon or of hydro-carbon gases generated in the circumstances described is possible.—The reply to this is, briefly, that carbon will not ignite "spontaneously," but that hot gas will.

2. In what proportions gases generated in such circumstances are explosive.—This was found to depend on the temperature at which they are evolved. At 1,000° C. bitumen gas will form an explosive mixture with air if it be present in any proportion between 5·4 and 20·5 per cent., while with gas from the pitch and whinstone mixture the limits are much wider apart, viz., 10·7 and 47·5 per cent. If the temperature is high enough to "crack" the gases, the limits of inflammability tend to widen, but the behaviour of the gases derived from the two materials becomes more nearly the same.

3. Whether pitch toughened with pitch oil, *e.g.*, as used by the Glasgow Corporation, is less dangerous than refined Trinidad bitumen.—In reply, it is stated that there is not much to choose between the materials so far as the volumes of inflammable gases evolved at 1,000° C. are concerned, but the pitch is likely to be more dangerous than the bitumen on account of the wider limits of inflammability and the greater content of hydrogen. The pitch and whinstone composition is more dangerous than the bitumen on account of the high percentage of poisonous carbon monoxide it contains, as well as the wider limits of inflammability. If the temperature of evolution be raised so that the gases are cracked the differences largely disappear, though the gas from the pitch and whinstone still contains a high percentage of carbon monoxide.

Interesting particulars are given of the composition of the gases evolved at progressively increasing temperatures, and of the volume produced. Attention is drawn to the fact that the results obtained are at variance with those published by Messrs. Thornton & Smythe in 1913. The Appendix concludes with a description of the apparatus and methods employed in the investigation.

These experiments go to show that the material originally used with the solid system—viz., Trinidad bitumen—is substantially safer than the materials which have in some cases been substituted for it with a view to cheapness, and there can be little doubt that its physical properties and its chemical inertness render it far superior to them as a protective covering for cables. There could be no more glaring instance of spoiling the ship for a ha'porth of—— bitumen than the saving of money on the filling of the trough, when the value of the cables to be protected and the cost of opening the ground, laying them, and reinstating the surface of the road or path are considered.

Whether the gases are likely to be cracked in the event of a fault is a matter of considerable importance on which at present there is no information. Most probably the answer is that sometimes they are and sometimes they are not. If the conductor fuses and interrupts the circuit without causing a short, probably there will be no cracking;

but if a bad short develop, the arc will play between the conductors, causing molten copper to be formed, carbonising the coverings of the cables and the troughing, if of wood, and warming up the ground for a radius of several feet round the fault. The gases will then be in contact with red-hot metal and carbon, and there is every likelihood of cracking taking place. That gas escaping from such a furnace as is thus set up underground will ignite merely on coming into contact with air is a most interesting fact, and one the knowledge of which is very valuable. We now know that we need not seek for the hypothetical, but often impossible, match to explain ignition, nor need we construct in imagination channels for the flame from the arc to flash back through to cause the explosion.

The large percentage of carbon monoxide found when pitch is distilled is important, as it shows that when gas from a faulty main does find its way into a building the danger to the occupants is far greater than that arising merely from risk of explosion; an explosive mixture may not be ignited, but no one can breathe carbon monoxide with impunity.

Appendix II describes the circumstances of various explosions investigated by the electrical adviser to the Board of Trade. The first two were similar to one another and occurred in 1908, one in Hamilton Place, Piccadilly, and the other in Pall Mall. In the first it is not clear what the conditions were as to fuses, but it would appear that the sub-district in which the fault took place was cut off from the rest of the network by fuses blowing, but not from the station. In Pall Mall there were no fuses. In both cases the mains were laid in bitumen casing, but although the fault in Hamilton Place occurred at a point in which it was assumed that water was lodging, the whole blame is laid on the bitumen, the possibility of hydrogen derived from electrolysis of the water not being mentioned. This report ends with some exceedingly inconclusive remarks as to the practicability of fuses on networks.

Mains laid solid furnish the material for the next report, which relates to an explosion in a feeder pillar in Battersea Park Road in 1909. The chief thing to note in this is that the ignition is ascribed to the assumed blowing of a fuse in the pillar; we now know from Mr. Wheeler's experiments that the gas may well have been self-ignited.

The fourth report is of an explosion in the Strand in 1911, which was in connection with cables in bitumen casing laid unusually near the surface over a cellar and near a disused coal shoot. On raising the lid of a box the gas immediately took fire, and shortly afterwards the explosion occurred in the basement of the adjoining building. The most noteworthy thing is that the mains were "districted," yet the cables were burnt right up to a box in which fuses were placed, but the fuses did not go. Surely this shows the absurdity of pinning one's faith on fuses for protection from explosions on underground networks.

The record explosion that has yet been experienced with bitumen mains forms the subject of the next report, which relates to the explosion on vulcanised bitumen cables laid in bitumen casing, which took place in 1911 at the Albert Hotel, Nottingham. It so happens that we saw these wrecked premises rather over a week after the occurrence, and the scene of devastation that they presented was a striking object-lesson as to what bitumen gas can do under certain conditions.

In most cases of fire or explosion, it is exceedingly difficult to be positive as to the exact circumstances of the fault, owing to the destruction that takes place. It is uncertain whether the fault was in this case on the main itself or at the point at which the service cables were jointed to it. Experience would most certainly point to the service, or the service joints, and a careful examination of the burnt-out mains and consideration of all the circumstances indicated that the mischief started on the main very near, if not at, the joint; it was almost certainly not on the service cables. The opinion expressed in the report is that it was not due to softening of the bitumen by coal gas (probably not) nor to wounding by "pick, spike or crowbar" (almost certainly not, as there was not the slightest evidence of such damage, which is usually very easily seen), nor to a crack in the dielectric. The explanation put forward seems to us rather far-fetched and exceedingly unlikely. It is suggested that one of the mains was ruptured and an arc took place between the broken ends, so heating the bitumen. This supposed rupture may, it is stated, have been due to settlement, though it is admitted as unlikely, or to the expansion of the cables during the previous summer (the explosion was in November!) or to a sudden fall of temperature during the night. It seems most improbable that the difference in temperature between night and day should have been felt in the conduits, composed as they are of heat-insulating material, laid underground beneath the pavements and kept warm by the normal current in the cables; added to all this, the fault had developed into a short by half an hour after midnight, so that the change of temperature must have been communicated to the cables in a very short period of time. Even assuming that all these objections can be explained away, it is incredible that the conductors, one quarter of a square inch in section, and composed of soft copper, would have parted under any stress that could have been put upon them by any of the supposed causes mentioned, bearing in mind that any subsidence that could have taken place must have been very slight. It seems to us far more probable that a leak had developed on the main, probably at the joint attaching the service cables, and that a burn-out took place in the usual way. Too much importance seems to us to be ascribed to there being nothing noticeable at the station until the short came on. A fault usually becomes bad suddenly, although its incipient stage may have been lengthy, and once it passes an appreciable amount of current it very rapidly goes from bad to worse.

We are told that "the shift engineers ran up additional engines to maintain the voltage," and a little later we have the interesting official pronouncement that "the shift engineers acted rightly in trying to keep up the supply and to keep it steady;" this will be balm to those who advocate the "column of smoke" type of testing indicator.

The recommendations include the ventilation of the casings at 60-yard intervals, the provision of expansion loops, the use of pipes suitably plugged for services, and the interconnection of districts by fuses, this last in the face of the fact that four lines higher up it is stated that in London three days earlier they had failed to prevent an explosion! The plugging of the pipes is a very necessary precaution which it is well to have pointed out.

The last report relates to the explosion at Hebburn in 1913, which was probably the determining cause of the appointment of the Committee. Two lives were unfortunately lost. The cables were insulated with vulcanised bitumen and laid solid in bitumen in wooden troughs. The main was close to the buildings and was under a cement pavement. The mischief was traced to a cable which was pulled tight against a mitred corner of the troughing. This must have been due to bad workmanship or subsidence; in view of the main having been down for 11 years, and the fact that subsidences are not uncommon in the district, the latter is the more probable. There must have been something abnormal about these mains or the district in which they were laid, as faults occurred at the rate of two or three per week. The most recently laid cables had been placed in separate earthenware troughs, with an inch space between adjacent troughs filled with earth. This practice is probably the origin of one of the recommendations of the Committee which we mentioned last week.

Boy Scouts as Engineering Apprentices.—The British Westinghouse Electric and Manufacturing Co. has forwarded a cheque for £100 to the Manchester effort in aid of the Boy Scout Endowment Fund. Mr. Philip A. Lange (managing director), in a covering note, states: "For some time past we have been watching with the keenest interest the good effect of the Boy Scout training on the general character of the boys belonging to the movement in comparison with others not so attached, and we issued instructions some time ago that preference should be given to Boy Scouts in selecting candidates for engineering trade apprenticeships. We are firmly convinced that Scout training increases the all-round capacity for learning a trade, and must result in producing a better class of skilled workmen."

D

THE FULLAGAR GAS ENGINE.

THE single-acting principle in heat engines, optional this hundred years so far as regards the steam engine, has been, to a great extent, a matter of compulsion in the gas engine. In all single-acting engines the crank shaft has been made the clearing house of energy. It has been called on to absorb all the energy of the explosions and to distribute such energy to the fly-wheel, and back again from the fly-wheel into the engine parts; to perform not only the external work but also the internal work of the engine.

The single-acting principle and the four-stroke cycle have made of the gas engine the heavy machine it is, and, as said above, it has appeared inevitable that such things should be. In the Clerk, the Körting, the Nuremberg, the Oechelhauser, and other engines, we have seen what has been done to get more power out of less weight of engine, but so far with very little success, and in engines of 2,000 H.P. the weights of the crank-shaft and other details are very imposing. We were present on July 8th at the demonstration at Newcastle of a totally new type of internal combustion engine, designed to reduce the gas engine to proportions more nearly in accord with what fits the notions of steam engineers. This engine was designed by Mr. H. F. Fullagar, and built some two years ago by Messrs. W. H. Allen, Son & Co., of Bedford, and it is at work in the power station in Gateshead of the Durham Electric Supply Co., where for three days last week it was to be seen motored round at 250 and at 300 R.P.M., and also running on a load of over 500 H.P. It was showing 575 v. and 700 amps. on the board. Put as briefly as possible, the engine is so designed that only the net work or B.H.P. gets into and goes through the crank-shaft. All the internal work of the engine, the inertia stresses of acceleration and of deceleration and the compression of the charge are performed between the four pistons, which constitute the "element," and the engine is very simple in construction.

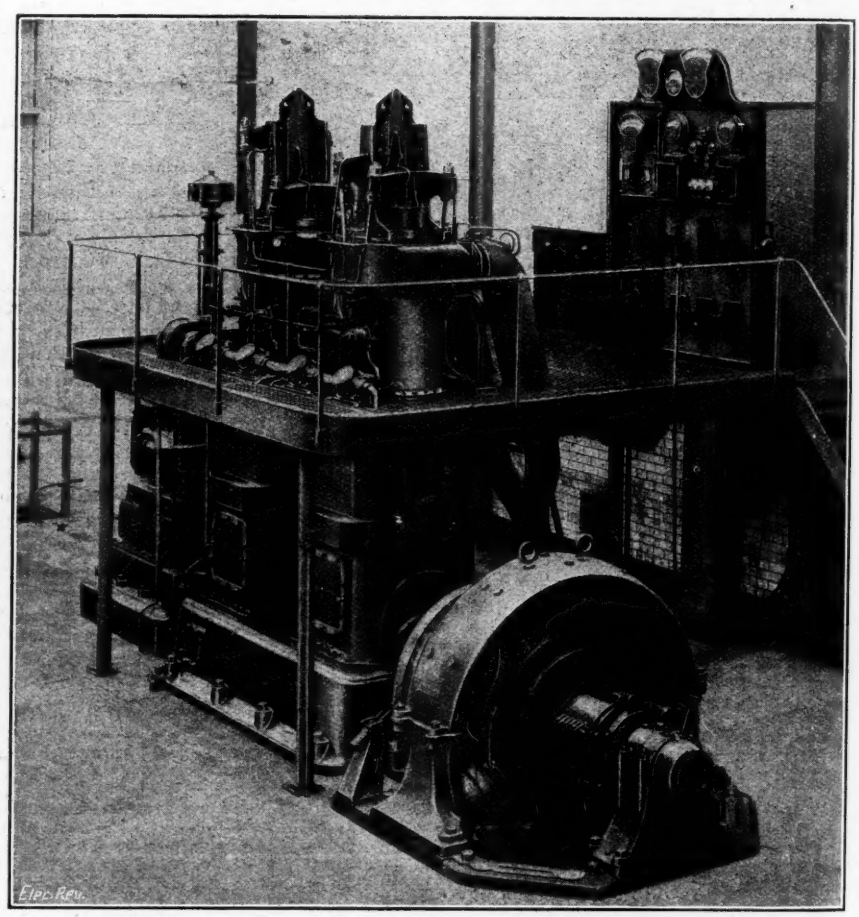


FIG. 1.—THE FULLAGAR 500-H.P. GAS ENGINE.

In fig. 2 the engine is diagrammatically illustrated. It possesses two closely-set side by side vertical cylinders and eight pistons. Taking one element of two cylinders, there are in one cylinder two pistons A, B, and in the other also two pistons C, D.

The two lower pistons B and D are each bolted to crossheads, and drive two connecting rods and cranks set at 180°, thus balancing each other very closely. To complete the balance as well as to obtain the other desiderata of the engine, the piston B is coupled to piston C by means of a pair of inclined side rods, which are firmly bolted to the crosshead below B and to the top of piston C; and piston D is similarly connected to the piston A. Gas mixture is admitted to the cylinder by the uncovering of a ring of ports through the cylinder wall by one piston, and the exhaust escapes at the other end of the cylinder by similar ports uncovered by the other piston. The charge is compressed between the two pistons and, the two cranks being opposite or 180° apart, compression is at its full pressure in one cylinder when the entry and exhaust ports are fully open in the other cylinder. Assuming that the charge is fixed between A and B, these two pistons are driven apart, the force of the explosion being charge is fired between A and B, these two pistons either directly or through the side rods. The remainder of the energy of explosion goes into the crankpin, and the bringing to rest at the end of the stroke of all four pistons is swallowed up either in compressing the charge between C and D or in driving the crank-shaft. But energy put into the crank-shaft does not come back again into the pistons. In the discussion which took place on the papers read at the meeting of the North-East Coast Institution of Engineers and Shipbuilders, at Newcastle, on Wednesday last week, doubts were expressed as to these side rods. But their inclination is much less than the obliquity of the connecting rods, and they are always in tension. The lateral pressure is defined by tan θ. W, where θ is the obliquity angle of the rods and W is the force on the pistons. And this side pressure is taken upon well lubricated slides which bear on the two sides of a vertical double-faced plate or side-bar, whch stands between but above the top of the two cylinders, the lower slides being similarly placed relatively to the lower ends of the cylinders. As with the side rods of a locomotive, these rods set up in themselves a bending moment by their own momentum, but the equiva-

lent length of the rods which tends to be bent by such momentum is not the rod length L, but a length which is $\sin\theta \cdot L$, and is little more than the diameter of one cylinder. Moreover the rods, unlike locomotive side rods, are fixed rigidly at each end.

In order that the two pairs of rods may clear each other, the crossheads to which they are bolted are asymmetrical to the extent of fully the diameter of a rod, but to make up for this the rod on the short arm of the crosshead is larger than that on the longer side, so that the stress and the balance are correct. Scavenging air, at Gateshead, is supplied by a motor-driven fan, but may be supplied by pumps driven off the engine like a marine air pump. Gas is supplied from a compressor, and is intended to be admitted late enough to avoid risk of escaping at the exhaust ports by turbulent mixing. Except for the disturbing effect of connecting rod obliquity, the balance of an engine element is perfect. The slight disturbance, due to obliquity, occurs twice in a revolution, but in a four-cylinder engine with cranks at 90° even these small disturbances are neutralized as regards vertical balance, though they may give a very slight moment along the longitudinal centre line of the two elements. But certainly this is so small as to be of no moment, as could plainly be seen in the running engine.

The pistons are oil cooled, oil being led through a telescopic sliding pipe into the hollow trunk piston, and being let out again into the crosshead slides on the sliding face of which is a + channel, which receives the oil, spreads it on the slide face, and delivers it to a hole in the slide, which is always in communication with a hole in the vertical channel of the cross. By this hole the oil finds its way back to the cooler, whence it is redrawn. As was demonstrated, a very few minutes served to disconnect one upper piston and lift it out upon the gallery floor, The lower piston being also unbolted from its crosshead, was then lifted out by a magnetic block. With a hand-worked crane, the whole of the eight pistons can be taken out in an hour.

The pistons are 12 inches diameter and the stroke is 1ft. 6in., and the piston speed is 750 feet per minute. The mean effective pressure is 70lb. per sq. in., and the stresses in the steel parts do not go beyond 4 tons per sq. in. and three-fourths of a ton in cast iron. The cylinders are free to expand, being single plain tubes, and they bear no engine or mechanism stresses. Some will have it that the engine is a mere variant of the Junker or Oechelhauser idea, but to this we cannot subscribe. That idea, with its cumbrous long side rods and with the crank-shaft made the receptacle of all stresses, has nothing in common with the Fullagar principle. Many attempts have been made to obtain perfect balance in engines, and some of these were given in Mr. Fullagar's paper at the Paris meeting of the Institution of Mechanical Engineers. These attempts include a variety of oppositely moving pistons, with pairs of similarly moving pistons at equal distances from a neutral centre. Then there is the case of the two cylinders inclined 90° from each other and working on one crank. There is the Oechelhauser principle and others, but in all the crank-shaft is made the clearing house of stresses. In the Fullagar engine the C.G. of a coupled pair of pistons moves up and down on the line PQ, and the two sets of coupled pistons balance in this common line. The connecting rod obliquity produces only a slight disturbance as in fig. 3, the C.G. of the whole mass rising and falling through a very small distance vertically, which happens twice in a revolution as stated.

In the engine at Newcastle the weight with flywheel is under 21½ tons, the four pairs of pistons weigh altogether about 2 tons, and the mechanical efficiency is over 90 per cent. Professor Hopkinson finds the two efficiencies I.H.P. and B.H.P. to be 37.6 and barely 30 per cent. respectively. Thus the B.H.P. efficiency is but little less than that of the Diesel, but the I.H.P. efficiency is several per cent. less, and shows therefore how much more mechanically efficient is the Fullagar engine. And the figures show also that the making direct of the stresses and avoiding the use of the crank-shaft as a general reservoir of torque has sufficed to bring the Fullagar engine very nearly up to Diesel efficiency. The four-cylinder engine is remarkably compact, and yet it can be dismantled promptly, and it occupies a very moderate space.

Professor Hopkinson made an attempt to put the theory of the two-cycle engine generally upon some sort of mathematical basis, but it can hardly be regarded as a subject for mathematical investigation. We may agree that two-cycle engines do lose fuel by way of the exhaust ports, but we can scarcely agree that it should be so. It is merely a matter of time and supply pressure. With oil and with coal gas of high calorific value, it should easily be pos-

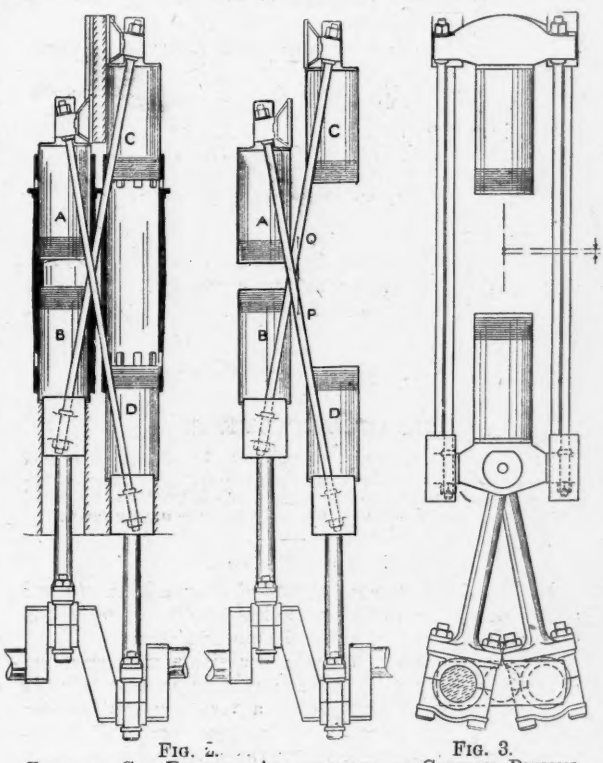


FIG. 2. FIG. 3.

FULLAGAR GAS ENGINE: ARRANGEMENT OF COUPLED PISTONS.

sible to inject the fuel after the exhaust port has closed. With producer gas there might be greater difficulty. It is, of course, certain that no stratification takes place. Stratification was perhaps suitable for "my learned brother" to make play with in the Courts, but its existence is entirely negatived by the rapidity of combustion which could only be possible in the presence of turbulency. Gas very quickly finds its way to an exhaust opening, and it is best to admit it if possible after the valve closes. We can hardly think there can be much fuel loss in the Fullagar engine if its efficiency is so nearly 30 per cent. This figure hardly squares with a loss of 21 per cent of fuel. But apparently the efficiency figure already given is only based on the allowance of 21 per cent. loss and not upon total gas consumption.

On the basis of the behaviour of water being like the behaviour of gas in an engine at 13 times the speed of the water, Professor Hodgkinson has tried to analyse the behaviour of a gas engine by employing fresh and salt water and comparing the relative losses at the exhaust on the basis of salinity, but the water model does not appear to have given any reliable results. Somehow we are inclined to doubt some of the rather far-fetched methods of probing

the behaviour of engines, and attempting to tie them up with rigid formulae. Nothing could surpass the excellent way in which the engine ran, and incidentally it may be remarked that the inclined side rods form an excellent and accurate indicator driving gear, a lever end armed with a little pulley being driven by contact with the rod. The inclined rod gives perfectly true movement to a pulley sliding in a straight path and very nearly the truth with a lever, the end of which moves in a curve.

The engine is well made and well arranged for overhaul and inspection, and it is purely a mechanical novelty and embodies no new combustion principle. But the novel arrangement of mechanism has most important effects on size, weight and space, as well as in the direction stress as already noted.

It may be added that the upper crossheads and guides may be made to act as air pumps in light high-speed types, thus economizing still further in weight and space, also that by slight variation in the timing of the ignition, the engine may be made to run equally well in a reversed direction.

On a test lasting 30 hours the following figures were obtained:—

		Corresponding Mean Pressure.
Average B.H.P.	510	50.5
Fan power	50	4.9
Gas pump	14	1.4
Engine friction and gas pump ...	67	6.6
Total I.H.P.	641	63.4

Gas consumption 18.1 cubic feet per B.H.P. hour measured at engine-room temperature. Calorific power 470 B.TH.U. per cubic foot.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Mica and Micanite.

May we claim the hospitality of your columns to call attention to the growing carelessness in drawing the distinction between mica and micanite insulation?

The distinction is important; micanite is an inferior and cheaper insulator, and, although ranking next to mica in value for this purpose, it is yet a very long way behind; the cement in it is liable to decompose under the action of ozone and to carbonise under the action of heat, whilst the breakdown strain of micanite under test is only about one-tenth to one-twelfth that of the mica from which it is made.

It is evident, therefore, that if micanite insulation is carelessly called "mica insulation," and is used in place of mica when mica insulation has been specified by the designer, a great source of weakness is introduced into the insulation of the machine—dynamo, motor or whatever it may be—that was never intended or calculated for by the designer, and this may lead to very serious trouble, besides saddling mica with faults that do not belong to it. The present careless methods are open to many grave and serious objections; for instance, let us suppose that "A" invites tenders for the construction of important electric motors, "mica is specified for the insulation of the commutators," "B," "C," and "D" quote. "B" and "C" quote for, and intend to use, mica for the commutators, "D" quotes intending to use micanite, sheltering himself under the careless use of the term "mica insulation," and is, of course, able to underquote "B" and "C"—all other things being equal—and so obtain the order. This is unfair to "A," who does not receive what he requires, and may even be a very serious matter if the motors are required for, say, a submarine, and a burn-out occurs during some important manœuvre, and it is also unfair to "B" and "C," who have correctly quoted for what was required.

It cannot be too strongly emphasised that mica should be kept as free from cements or organic material as possible, as these are only a weakness and operate against its splendid insulating properties. There seems to be an erroneous impression, too, amongst buyers that mica cannot be obtained for commutators, &c., in lengths of more than 6 in. or so. This, of course, is utterly wrong; mica can be obtained in lengths of 20 in., or more, quite readily. If anyone interested cares to call at our warehouses in the Minories, London, E., we can very quickly convince them that large mica is freely obtainable; we can show them tons of it.

Again, great confusion is caused by referring to micanite tubes as "mica tubes." A mica tube is a tube made of rolled mica all in one length, that is, a 12-in. mica tube is made from pieces of mica 12 in. long rolled up without any cement of any kind. A micanite tube is made up of innumerable little pieces all cemented together, and is, of course, a totally different thing, open to all the objections mentioned above in drawing the distinction between mica and micanite. Further confusion is caused by miscalling a micanite-and-paper tube a "micanite tube." The proper specifications for the various tubes are as follows:—

A "Paper tube."—A tube made of various impregnated papers generally specified by some fancy name according to the maker.

A "Micanite and paper tube."—A tube made up of alternate layers of micanite and paper.

A "Micanite tube."—A tube made of micanite only.

A "Baked micanite tube."—A tube made of micanite only and then baked.

A "Mica tube."—A tube made of rolled mica only without cement.

Surely this is the only common-sense designation! It would certainly obviate the confusion that reigns at present, and as any other method such as calling a micanite-and-paper tube a "micanite tube," or a micanite tube a "mica tube," is incorrect and liable to lead to the substitution of an inferior quality of tube to that required, we would suggest the adoption of the above correct designations by everyone concerned.

We do not know whether this is within the scope of the Electrical Standards Committee, if so, perhaps you would be good enough to draw their attention to the matter; if not, perhaps the I.E.E. would take up the question of the proper standards for the various insulating materials used by the electrical industry, as some such standard is very greatly needed.

We supply both mica and micanite in large quantities, as is well known, so it is immaterial to us which material an engineer wishes to use, but we feel that it is to the interests not only of the buyers and users, but also of the responsible members of our own trade that specifications should be drawn up more carefully, the material required more accurately stated, and a more careful supervision exercised to see that the specified material is supplied, not some lower quality.

Wiggins & Sons.

London, E.C., *July 8th*, 1914.

Difficulties in Canada.

I read with interest your leading article and notes from your correspondent on difficulties in Canada, in connection with which I shall be glad if you can spare me some of your valuable space in which to make a few remarks. May I point out, as one solution of the case that you give, viz., the meter contract, that in Canada very large corporations are, in a lot of cases, governed by practically the same directorate. To anybody who knows the electrical business in this country, this hint should be sufficient.

Now, dealing with your remarks and those of your correspondent, with reference to the British manufacturer, my experience shows me that the fault is entirely with the British manufacturer himself. I will give you an instance. I had an introduction to a large firm of manufacturers of electrical specialities for which there should be a good market in Canada if properly pushed. I wrote these people asking for their terms, and this is what they offered me: I have to guarantee to take a certain quantity of their goods to the value of a goodly sum within the first year,

also I have to buy about £200 worth of goods as samples. For this they are going to allow me 20 per cent. discount and I have to pay cash against shipping documents in London.

In return for this, all I have to do is to put a new article on the market, send a man over a further distance than from London to Montreal, viz., Montreal to Vancouver, to do my utmost to advertise their goods, and probably take some orders on which I have to give at least 90 days' credit. You will see from this how British manufacturers show their complete ignorance of trade conditions out here. In this instance especially, the "cash against shipping documents in London" is amusing, as I am only representing English houses out here, the names of which appear at the head of my paper, so it would not have been very difficult for this house to have found out whether I was a substantial man or otherwise.

If the British manufacturer only knew the opportunities he is losing in this country, I feel sure that some progressive firms would get live agents out here, and although they would probably have to sink a year's expenses before seeing any results, the ultimate end would not only mean satisfaction to them, but the establishment of a permanent business in the Colony. In conclusion, I would say that if the British manufacturer took a lesson from the American manufacturer, who first decides on his agent, and having done so trusts him and supports him in every conceivable way, I do not think there would be the necessity for the continual cry both from over there and over here of: "Why are there not more British electrical goods on the Canadian market?"

I trust you will excuse this trespassing on your valuable space, but as an Englishman in Canada I feel that we are not being done justice by our home manufacturers, in a country which without doubt has greater possibilities for the electrical industry in general than any other country in the world.

Michael S. Parnell-Smith.

Montreal, *July 2nd*, 1914.

Switchgear Contracts: Expenses of Tendering.

By direction of my Council, I have the pleasure to enclose a copy of a letter which I addressed to the Secretary of the Incorporated Municipal Electrical Association on May 25th, together with a copy of his reply, dated the 13th ult.

D. N. Dunlop, *Secretary,*
British Electrical and Allied Manufacturers' Association.

London, W.C., *July 13th*, 1914.

[COPY.]

H. Faraday Proctor, Esq.,
Hon. Secretary, I.M.E.A.,
The Exchange, Bristol.

Dear Sir,—I am directed to inform you that the Association is proposing to send to the Press a letter having reference to the difficulty and expense which contractors are asked to incur in tendering for switchgear, with particular regard to the form of tender recently issued by Dundalk U.D.C., which involved the apparently unnecessary splitting up of the price into 80 separate items.

In this connection I am to recall to you the letter (copy enclosed) from the Association, dated October 25th, 1912, which appeared in the ELECTRICAL REVIEW for November 1st, 1912, dealing with another branch of the same subject; and I am, before writing to the Press, to ask you to be kind enough to state whether an appeal by the Association to municipal switchgear purchasers asking that more care be given to avoiding unnecessary expense and trouble in this connection would have the sympathy and support of the I.M.E.A.

Very truly yours,
(Signed) D. N. DUNLOP,
Secretary.

(Copy of letter above referred to.)

October 25th, 1912.

To the Editors of the ELECTRICAL REVIEW.

SWITCHGEAR DRAWING OFFICE EXPENSES.

Dear Sirs,—I am directed by my Council to invite, through the medium of your valued paper, the attention of municipal and consulting engineers and other principals interested in the purchase of switchboards, switchgear, and apparatus, to the burden at present imposed upon manufacturers by demands for drawings, the cost of preparing which is, in many instances, largely disproportionate to the value of the orders for which they are prepared.

It appears to be customary—the custom originating, no doubt, in competition, and now sanctioned by use—in every instance, at the inquiry stage of a switchgear order, for purchasers to ask each tenderer for special drawings, irrespective of the size or value of the apparatus inquired for; and it is, thus, not unusual for a maker, when acting as sub-contractor, to be requested by a dozen different firms to supply, for tendering purposes, of each section of the order, a dozen sets of drawings in duplicate, together with blue prints and diagrams of connections and dimensions, the order itself being of the value of, perhaps, not more than £10. In the case of intermediate sub-contractors making the demand on behalf of some main contractor, the work is doubled, and may even be quadrupled.

It is submitted by members that while, in the case of large special switchboards, detailed lay-out drawings may reasonably be required, in the majority of cases an immense wastage of time and labour takes place in the manufacturers' drawing offices, most of the drawings demanded being unnecessary for the immediate purpose; and that simple illustrations of the apparatus offered would, in the first instance, be amply sufficient to enable purchasers or their engineers to decide as to the tenderer, or tenderers, to whom they will, in the first instance, give the preference, who could then be required to submit the necessary drawings.

The grievance is, moreover, as it appears, not confined to the tender stage. In the contract stage also the drawings required are, members submit, frequently excessive in number and variety, and unnecessarily detailed. In the case of motor panels, for example, of which a large number are sometimes ordered at one time, it is not unusual for three or more dimensional prints of each panel to be asked for.

My Council conceive that, in many instances, excessive demands for drawings may arise from thoughtlessness or lack of knowledge on the part of purchasers' assistants, who habitually, and, perhaps, excusably, make them as a matter of routine, with every inquiry or order passing through their hands, specifications usually embodying "covering" provisions as to the drawings which shall be supplied if required.

From whatever cause arising, however, my Council feel assured that a remedy will be found for the grievance, and that, so far as it lies within the power of purchasers to apply it, the remedy will be applied. The interests of both parties are obviously served in the end by keeping down charges for unproductive labour; and the total amount of drawing-office charges incurred yearly by manufacturers as a body is, under the present system, very large indeed, having regard to the fact that only one or two out of the 20 or more tendering firms can possibly get any order.

Your obedient servant,
(Signed) D. N. DUNLOP,
Secretary.

INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

[COPY.] *June 13th*, 1914.

D. N. Dunlop, Esq.
Secretary, B.E.A.M.A.,
36, Kingsway, W.C.

EXPENSES OF TENDERING: SWITCHGEAR CONTRACTS.

Dear Mr. Dunlop,—With reference to your letter of May 25th: There has not been an opportunity to bring this matter before the I.M.E.A. Council, and I fear that an opportunity will not arise for some little time owing to the holding of the Convention next week.

I feel sure that the Council would sympathise with the expressions contained in your letter to the Press dated October 25th, 1912. Indeed, if I remember rightly, this matter has already been dealt with by the Council and publicity given to their views, although I cannot at the moment remember the exact reference in the Press. I think that probably you will be able to turn up the reference as well as we can, as the matter was, I think, brought forward at your instigation, referring to the expense of tendering, more particularly in connection with switchgear.

Yours faithfully,
H. FARADAY PROCTOR,
Hon. Sec. I.M.E.A.

The Policy of the A.E.S.E.

Some time ago I was instructed by the Executive Committee of the A.E.S.E. to write the electrical Press emphasising the peacefulness of the methods of the A.E.S.E., and the great abhorrence of a strike, and the fact that the A.E.S.E. would plough a lonely furrow and not take action with or combine with any other association or Trade Union.

Now I have to record the following episode; there have been several somewhat similar:—

Recently I stated in these columns regading the Coventry Corporation electricity department that, although this department had the lowest working cost per unit in the country, they paid the lowest average salaries to their charge engineers compared with stations of about similar capacity.

Subsequently, the A.E.S.E. had occasion to write the Coventry Electricity Committee, asking that an increase of salary be granted to the charge engineers and switchboard attendants. A copy was also sent to the chief engineer asking him to support the application.

The salaries at Coventry, at the time of sending this letter, were as follows:—(1) One charge engineer, £3 per week, with about 14 years' service; (2) One charge engineer, £2 10s. per week, with about eight years' service; (3) One charge engineer, £2 10s. per week, with about eight years' service; (4) One charge engineer, £1 15s. per week, with about five years' service; switchboard attendants, £1 5s. (No fixed scale of increase.)

No. 4 was designated on the books of the department as a switchboard attendant, but has actually taken turn with No. 3 with exactly similar duties for the last three years; Nos. 2 and 1 take turn with each other, and duties are similar. The stumbling block to the chief engineer seems to have been No. 4 at 35s. per week.

Within two days of the receipt of this application, and before the Electricity Committee had considered it, an order was issued in the station that the charge engineer, referred to above as No. 4, should be ranked and take duties with the switchboard attendants, whose money was increased to 27s. 6d. per week, and who were to act as charge engineers on certain specified occasions, which rendered the situation absurd, owing to the fact that at times the charge engineer No. 4 would be acting as switchboard attendant under the charge of a youth under 21 years of age, with only a few months' experience in the station. Evidently this was done to try and get rid of the charge engineer No. 4, and keep down the salaries, whilst making the rates paid to the charge engineers appear higher.

The charge engineer concerned protested to the chief engineer, who made the usual reply under such circumstances that "he was manager of the undertaking and would do as he liked."

On the advice of the A.E.S.E. the charge engineer appealed to the Electricity Committee, protesting against the order and asking for an interview. The same day as the chairman of the Committee received the letter the charge engineer was dismissed at a moment's notice. I may here remark that the station superintendent refused to dismiss the man, and the chief engineer, perforce, had to do it himself by letter, enclosing a week's money in lieu of notice.

In the meantime the A.E.S.E. had written the Committee *re* the above order issued at the works, and also wrote and protested against the dismissal. It was pointed out to the Committee that the order issued at the works was contrary to the Home Office electricity regulations; consequently the order has been withdrawn, but the Committee refuses to reinstate the engineer who was discharged.

Now I come to the victimisation part of the case. The charge engineer has been dismissed at a moment's notice for protesting to the Committee (after an abortive interview with the chief engineer) against an order which was contrary to the Home Office electricity regulations, and which has since been withdrawn.

The chief engineer has verbally given the reason for dismissal as "over-riding the manager of the undertaking." He also stated that if the charge engineer was dissatisfied he should quietly give notice and leave. I wonder if the chief engineer would have done this if the Electricity Committee had issued an order with which he was dissatisfied? From what I know of him the answer would be decidedly in the negative.

The chief engineer's reply in writing, in answer to the inquiry as to the reason of the dismissal, is: "You surely have the necessary intelligence and common sense to understand the reason of your discharge."

An inquiry for a testimonial resulted as follows: "I am in receipt of your letter of the 8th, and note that it was on advice you received you acted, which necessitated your dismissal, and by which I am prevented from granting you a testimonial."

These replies speak for themselves, and need no comment.

The inference from this episode is obvious. The A.E.S.E. must seriously consider the adoption of a policy to protect its members and station engineers generally from such victimisation. At first it was thought that very similar cases were isolated cases, but they have been so numerous that the word isolated does not now apply.

As some of the supply authorities take up a fighting attitude, the A.E.S.E. must consider a strong policy to counteract this. The Association, to be effective in a case like the foregoing, will have to reverse its previous decisions as enumerated in the first paragraph of this letter and be prepared to co-operate with other organisations represented in electrical stations, and adopt a more aggressive policy.

A number of members with whom I have consulted, including the acting sub-committee of the executive, have reluctantly come to the above conclusion, and the matter is to be put to the whole of the members at an early date.

This decision has been forced on us, and if there is anyone who can see any other way of preventing this kind of victimisation by chief engineers and their committees, the Association will be glad of the advice.

The large number of gentlemen who so kindly wrote me in February last advising the Association to proceed on peaceful lines and keep clear of other organisations perhaps will write to the chief engineer and committee at Coventry, advising them to proceed peacefully, as they have taken the most drastic action possible.

It seems to me unfair that the citizens of Coventry may have to be inconvenienced before the injustice meted out to one man can be righted.

I appeal to all station and mains engineers, members and non-members of the A.E.S.E. to support us in this particular case (one never knows who may be the next to be victimised), and stand by a colleague who has been victimised in a struggle after that fetish, the lowest working cost.

Station engineers must choose now, once for all, between a fighting organisation that can protect its members from victimisation, or a passive one that cannot.

Read Mr. Ashmore Baker's article entitled "The Organisation of the Electrical Industry" in last week's ELECTRICAL REVIEW, and think out how such an ideal organisation as he suggests could get the modern Corporation Electricity Committee to agree to and adopt any findings agreed to by, say, the I.M.E.A. and the A.E.S.E. without sometimes using the element of force. (The I.M.E.A. has refused to deal in any way with the rates of pay and hours worked in electrical stations.)

All station and mains engineers must in future stand shoulder to shoulder and honourably support their colleagues in all cases of victimisation and unjust conditions; otherwise they will be pushed out of their places by the better organised labourer, as has already happened in a number of stations.

W. J. Ebben,
Hon. Gen. Sec. of the A.E.S.E.

London, N.E., *July 14th*, 1914.

The Qualifications of a Consulting Electrical Engineer.

In your issue of May 15th, and your article on "The Liabilities of Consulting Engineers and Architects," page 810, you state:—

"So far, then, the facts of the case appear to be that an important electrical installation is to be carried out on a system which is not in accordance with the rules of the Institution of Electrical Engineers . . . . and the work is to be supervised by a consulting engineer who is not a member of the Institution of Electrical Engineers.

"It is distasteful to have to refer to this point, but we feel bound to do so in the interests of a large body of qualified consulting electrical engineers, &c."

I infer from this that you consider that only members of the I.E.E. are qualified members of the electrical profession, and should be glad if you would inform me, through the medium of your paper, if I am correct.

Unqualified.

Borneo, *June 15th*, 1914.

[Our correspondent's inference is not correct. If he will again read our remarks carefully, he will see that we referred only to consulting electrical engineers. No doubt there are many electrical engineers of first-class ability who do not belong to the Institution of Electrical Engineers;

that is their own affair, and we do not criticise their decision. But when a man offers his services to the public as a consultant, whether he be a physician, an architect, or an electrical engineer, he ought to avail himself of such means as are open to him to prove that his qualifications are recognised by the members of his own profession.—EDS. ELEC. REV.]

ELECTRICAL ACCIDENTS IN 1913.

THE report of the electrical inspector, Mr. G. Scott Ram, on electrical accidents in 1913 was issued last week. The following are extracts from his statement:—According to the latest tables showing the position of electric motive power at the end of the year, the increase during the year was again a record one. No less than 181,000 H.P., representing an increase of 20 per cent., was added during the year, the total amount for the undertakings included in the returns being now well over a million horse-power (1,081,500). As many as 22 undertakings do not give any returns, and with one exception the large electrical power companies are not included. The supply to mines is mostly from the latter. Factories having their own generating plant are also not included, so that it is safe to conclude that the horse-power of motors on factory premises is well over a million.

TABLE I.—ACCIDENTS AT ELECTRICAL GENERATING STATIONS AND SUB-STATIONS IN 1913.

(The small figures relate to fatal accidents, and are included in the principal figures.)

Description.	Public supply stations and electric railways and tramways.	Other stations.
Non-Electrical:—		
At engines, pumps and generators	30[1]	9
At boilers and steam plant	84	4
At coal-handling plant	15[2]	5
Falls	111[4]	10
Struck by falling bodies	43	3
Miscellaneous	109	16
Total	392[7]	47
Electrical:—		
At switchboards when engaged in ordinary routine work	12	7
Cleaning, repairing, &c., at "live" switchboards or other "live" conductors	31[1]	15[1]
Cleaning, repairing, or other handling of switchboards supposed to have been made "dead."	6	—
Adjusting brushes and cleaning commutators, and flashing at commutators	5	2
Miscellaneous	11[1]	5
Total	65[2]	29[1]

The mechanical accidents show an increase of 68, or 18 per cent., over the previous year's totals. The accidents are such as are liable to occur in engineering works generally. The increase is mostly under the heading of falls, although there is a considerable addition (25) to the accidents connected with boilers and steam plant.

The electrical accidents are remarkably few in view of the large number of electrical stations now in operation. Although the number of accidents is greater than in the previous year, it is no larger than it was five years ago. Under the first heading, eight of the accidents were due to mistakes on the part of the switchmen, the others being due to faulty apparatus. The next class—cleaning, repairing, &c., at live switchboards—is, as usual, the largest, accounting for no less than 46 of the total, and includes a number of accidents which are clearly of a preventable nature. Six of them occurred to men working on or near high-tension apparatus without taking proper precautions, and it is remarkable that none of them had fatal results. In one case, in a sub-station, two men were about to connect up a transformer in a chamber in which all the conductors had been made dead. They took in a length of bare copper wire, and were connecting one end of this to the transformer; the other end being free curled round the doorway and made contact with a bare conductor at 10,000 volts in the adjoining room. Another accident was due to the man assuming that a conductor at extra-high-pressure being heavily taped up with insulating tape was safe to handle, but the insulation broke down. In another case, three experienced engineers were discussing some proposed alterations in an extra-high-tension chamber, one of them standing so close to the apparatus that he inadvertently touched it with his elbow. In another case a man was cleaning switchgear in a sub-station and touched the terminals of the incoming main, which, through inadequate supervision, had been left live. Of the accidents at medium-pressure switchboards two had fatal results. In one case a new transformer had to be connected up in a large sub-station in place of one which had failed, and the engineer was making a test at the oil switch on the secondary (440 volts) to ascertain if the transformer was correctly connected. This oil switch was in a narrow chamber into which the man had to crawl below other oil switches, and was not intended for use as a switchboard passage-way. In this confined space he made a short-circuit and was killed. There was no necessity to make the test in the chamber at all. It could have been safely made in the transformer room, and should have been made there in accordance with the instructions given by the engineer in charge of the work. In the other fatal case the man was working on a live switchboard contrary to standing instructions, and was connecting up a new cable. He was standing on an earthed transformer case, and touched a live conductor, 420 volts alternating. In this case the man was rendered insensible and was brought round by artificial respiration. He was then at his own request allowed to get up and walk, when he again collapsed and succumbed to heart failure. Of the non-fatal accidents 13 were due to the use of ordinary engine-room spanners, pliers, &c., on live switchboards, and need not have occurred had proper insulated tools been provided; short circuits resulted, inflicting severe burns. In a further case a short circuit was made on the switchboard by the wire guard of a hand-lamp. Hand-lamps having guards of non-metallic material are available, and should be kept for use behind switchboards and in battery rooms and other places where portable lights are required close to live conductors. Two accidents occurred in removing oil switch tanks from live switches. Short circuits occurred, and in one case the burning oil was shot out, injuring two persons. Three accidents occurred to persons engaged in cleaning live switchboards.

The six accidents due to working on switchboards supposed to have been made dead were all on high tension, none, however, having fatal results, although the injuries were in some cases very severe. With one exception, they occurred to skilled men and were due to forgetfulness or carelessness. In one case the charge engineer of the station had had one cell of a large switchboard made dead for examination and inadvertently opened the door of the adjoining cell, which was live, and took hold of the conductors (6,600 volts). He was rendered unconscious and was badly burned. He was brought round by the Schäfer method of artificial respiration. In a second case of a man opening the wrong door, he had not taken the trouble to turn on the light in a dark passage-way and the mistake was probably due to this. In the case of the unskilled man, a bricklayer had been fixing some insulators in a dead cell. Later on he opened the cell to ascertain if the cement had set firmly, the conductors in the meantime having been made live. In another case the man opened a feeder cell without having ascertained whether it was live from another station. In another case a generator oil switch failed to act properly when the remote-control switch was operated, and two engineers went to examine it and made a short circuit, forgetting that the generator was still running and excited; one of them was severely burned.

Of the seven accidents at commutators, five were due to flash-overs causing burns or "flash blindness."

Amongst the miscellaneous accidents, the fatal case occurred to a man scaling a boiler. He received a shock (230 volts alternating) from the flexible conductors of a hand-lamp, the insulation being practically worn out and in a dilapidated condition. In another case a boiler cleaner was rendered unconscious by contact with the conductors of an improperly constructed connector used within the boiler for connecting a hand lamp.

TABLE II.—ELECTRICAL ACCIDENTS IN FACTORIES, OTHER THAN ELECTRICAL STATIONS, 1913.

The small figures relate to fatal accidents and are included in the principal figures.

Arcing of switches	56
Arcing of fuses	17
Shock or burns when replacing fuse wires	35[1*]
Portable apparatus, connectors and flexible wires	66[3]
Unprotected conductors, switches, terminals, fuses, &c.	42[5]
Working on or near live conductors—skilled persons	42[2†]
Working on or near live conductors—unskilled persons	43[3]
Miscellaneous accidents in electrical manufacturing and repair work—mostly in testing operations	66[1]
Adjusting brushes and cleaning commutators and flashing at commutators	10
Miscellaneous	41[2‡]
Total	418[17]

* Fatality due to blood poisoning following burns. † One fatality due to fall. ‡ Both fatalities due to falls.

The number of accidents reported in regard to factory premises other than electrical stations, as shown in the above table, presents a considerable increase over the total for the previous year—418, as against 283, with 17 fatalities, as against 15. Although for several years the number has been practically stationary, it is hardly surprising that an increase should have to be recorded, consequent upon the enormous extension in the use of electrical energy. Examination of the circumstances of the accidents indicates generally that a large number are due to inadequate skilled supervision both as regards the initial selection and installation of the plant, and as to its subsequent working and maintenance. In many works of considerable size operated and lighted by electricity, there is no one employed who is technically qualified to look after the plant. Even if the plant is good and well-installed in the first instance, it is often run without technical supervision until trouble arises and accidents occur. Thus, under the first heading in the table, the accidents from arcing of switches have arisen from 23 in 1912 to 56 in the year under review. Nearly all these accidents are due to neglect of proper maintenance of the plant, either of the switches themselves or of the apparatus which they control, by reason of the lack of skilled attention. Trouble naturally comes sooner where the apparatus is of a flimsy and cheap character in the first instance. Many of these accidents occur at

motor starting panels, through the failure, due to poor construction, of the starting rheostat. This becomes burned at the contacts, which, not being attended to, get into such a condition that the automatic release fails to operate on shutting down. The workman, not noticing this, switches on again at the main switch with all the starting resistance cut out, producing a flare-up at the switch and getting his hand, and perhaps his face, burned. Switches having covers with slots for the handles to work through offer no protection under these circumstances, the flash coming through the slot.

The accidents from arcing of fuses were due to the absence of proper protection, some of the fuses, consisting merely of bare wires, being placed close to switch handles, an arrangement which invites accident.

The accidents in renewing fuses are almost entirely due to the use of unsuitable and dangerous types of fuse mountings or holders unprotected by switches.

The accidents incidental to the use of portable apparatus include three fatalities, all being due to the use of hand-lamps of obsolete type having the lampholder in connection with the other metal work and the metal work not being earthed. Each occurred with alternating current of low pressure. A similar fatality occurred on premises not under the Act (theatre) and was investigated, but is not included in the table. In another case a man had a remarkable escape from death in the use of such a lamp. He was standing on a damp brick floor holding the lamp when he received a shock and, as is usual in such cases, was unable to drop the lamp or otherwise release himself. He was able, however, to call to another man working near to switch off the current. This was done at an ordinary tumbler switch in one conductor of the circuit. The second man then went to the assistance of the first, who had fallen over, and took hold of him to lift him up, but himself received a severe shock. Two other men then came up and received shocks from the first man on trying to assist him. They then went to find the man in charge of the electrical plant who was in some other part of the works. This man having eventually arrived at the scene of the accident, pulled the wires out of the connector and broke the circuit. The victim of the accident was unconscious for a long time, and his hands were severely burned where he had held the lamp. The current was alternating and nominally of 110 volts pressure, but actually 440 volts, the "reduction" in pressure being obtained from an "auto" transformer, so that whilst the difference of pressure between the two lamp wires was only 110 volts, the pressure to earth was actually 440 volts. The switch being in one wire only, did not of course cut off the pressure. The case is interesting as showing the utter disregard of requirements of the Regulations and of elementary provision for safety, and unfortunately affords an example of a good deal of work which has been put up during the last few years. Another shock accident occurred from a portable lamp, but without serious consequences. In this case the portable lamp consisted only of a lamp in a metal lampholder attached to the flexible conductors. This improvised form of portable lamp is very commonly used where a properly constructed hand lamp is not at hand and by persons who ought to realise the danger. Several fatalities due to the use of this temporary expedient have occurred in the past. In the case of two of the hand lamp accidents, proceedings were taken for breaches of the Regulations, and heavy fines were imposed. Other accidents occurred in the use of flat irons and drills. The accidents occurring actually with the portable apparatus, although few in number, are generally shock accidents and consequently liable to be dangerous to life. The majority of the accidents in the use of portable apparatus occur, however, in the handling of the connectors (27) and the flexible conductors (26), and the injuries are usually burns from short circuits. In the case of the connectors, they would be avoided by the use of connector-plugs of the hand-shield type described in my earlier reports or other safety types, or connectors protected by a switch so arranged that the plug can only be put in or out whilst the switch is in the "off" position. The accidents from short circuits in the flexible conductors are due to the use of worn-out and dilapidated wire, or to the fact that the protecting covering in the first instance has not been adequate either as to thickness or material. Considerable trouble is often experienced with the flexible conductors for electric irons, short circuits occurring at the point where they are led away from the iron, due to constant bending of the wire and insulation and to the heat from the iron.

Under the next heading—unprotected conductors—there were five fatalities. The first occurred in a shed in a motor-car works. The lighting was by 200 volts alternating current. In order to provide for the use of a portable lamp, two wires about 4 ft. in length had been connected to the circuit at a ceiling rose of a pendant fitting. Instead of using a "properly constructed connector" the ends of the flexible wires for the portable lamp were twisted on to the ends of the wires from the ceiling rose by a man standing in a car whenever the lamp was required. At the time of the accident there was no portable lamp connected, and the wires from the ceiling rose were hanging down, the live ends being unprotected. Three men were pushing a car into the shed when the metal frame of the wind screen came into contact with the live wire. Two of the men received shocks, one being killed. The second fatality occurred in an engineering works. A connector socket for use with a portable lamp, 200 volts alternating, was fixed to a drilling machine. The protecting cover of the connector had been broken, leaving the live contacts exposed. The machinist climbed up to do some oiling, and put his hand on the live contacts and was killed. The third fatality was due to the non-earthing of the guide wires and winch of the raising and lowering gear of an arc lamp (220 volts alternating). A leakage occurred in the lamp, rendering the framework live and also the guide wires. A man took hold of the latter and was killed. The fourth fatality was due to the want of protection of the trolley wires of a travelling crane close to the driving cabin, the driver putting his hand on the wires whilst leaning over the side of the cabin (440 volts alternating). The fifth fatality was due to the inadequate protection and maintenance of wires on a coke oven compressor exposed to the weather and subjected to severe vibration. The outer protection of the wires had entirely disappeared, and the insulating covering of the wire was cut through where it entered a metal lamp standard attached to a wooden rail. On a wet day a man leaning on the rail close to the metal tube received a shock which killed him (400 volts alternating). Another man in attempting to pull him away also received a shock. Of the non-fatal accidents, 10 occurred at electric cranes from the absence of proper protection of the conductors in or about the driving cages. In five instances the crane drivers fell to the ground from considerable heights when getting in or out of the cage, due to touching the live conductors. The remaining accidents under this heading do not admit of classification. One is interesting on account of the low voltage. A man was severely injured by shock and burns by contact with a terminal block of an electric furnace working at 60 volts alternating. Apparently he was unable to release himself.

(*To be concluded.*)

ELECTRIC SIGNALLING ON FRENCH RAILWAYS.

At the recent meeting of the Institution of Mechanical Engineers in Paris, a number of papers by French engineers were read, describing the methods of signalling to railway trains in motion which are employed in France.

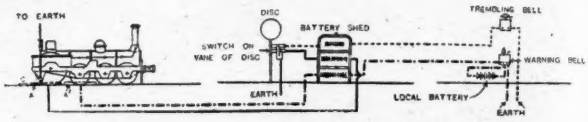
Mr. A. Sartiaux, engineer-in-chief of the traffic and working department of the Chemin de fer du Nord, explained the system now being used experimentally on that railway.

A fixed ramp is set in the centre of the track, parallel to the rails at a distance from the signal, varying, as the case may be, from the foot of the signal itself to 200 m. Fig. 1 is a diagram of the electric circuit.

The ramp consists of an oak beam 2 m. long, resting on two wrought-iron supports, and carries a cover-plate of brass connected to the wire from the battery.

If the speed of the train exceeds 50 km. (31 miles) per hour, two such ramps are used, to increase the duration of contact.

A shield is provided to protect the nose of the ramp from being caught by any piece projecting from the engines or the carriages. The surface of the brass plate should be 10 cm. above the level of the rails.



Full lines show connection from signal to blow whistle.
Dot and dash lines show connection from engine to warning bell.

Fig. 1.—Diagram of Electric Circuit.

An electro-automatic whistle warns drivers that they are reaching a distant signal set at "danger." This apparatus is installed on all locomotives, with a strong spring continually tending to pull the lever down, and let steam or compressed air into the whistle. The lever is held up by a Hughes electro-magnet; if a current be sent through the coils in a certain direction, the magnet immediately ceases to attract its armature, the lever comes down and the whistle keeps going until the driver resets the lever.

One of the wires of the electro-magnet working the whistle connects with the body of the engine and goes to earth through the wheels and the rails; the other wire goes under the engine through an insulated cable, and connects on to a brush consisting of a series of small brooms of hard but elastic copper wire, soldered on to a metallic plate, and making contact with the ramp.

The signal vane is provided with a switch which is worked by a finger keyed on the signal post. This switch serves to control the position of the signal vane as well as to release the whistle. It is adjusted so as to work the bell registering at the station the position of the signal, and to release the whistle the moment the disk has turned 70° round from its normal position of "line clear." The brass plate having been connected with the positive pole of the battery placed near the disk, the negative pole joins on to the switch, which sends the current to earth when the disk is turned to danger, and disconnects it the whole time the line is clear.

The battery registering at the station the position of the signal vane has eight cells, the one connected to the fixed ramp has 12 cells. Both batteries are protected in a little cement shed built at the foot of the signal post.

The indicator for trains passing distant signals is intended to give audible and optical warning to the station officials and the pointsman that a train is approaching. It consists of two fixed ramps AA', fig. 1, the first of which works the electro-automatic whistle as aforesaid, and the second the warning bell every time a

train or an engine goes over it, irrespective of the position of the signal vane.

The warning apparatus installed in the signal box consists of a loud warning bell provided with a little vane which becomes visible when the Hughes electro-magnet, which is inside the apparatus, has been released by the brush going over the second fixed ramp. The appearing vane closes the circuit of a local battery, in which is a loud trembling bell.

MR. F. LANCRENON, locomotive and rolling-stock superintendent, described the electrical warning and recording apparatus in use upon a number of locomotives on the Chemins de fer de l'Est.

In this case also a ramp of similar design is placed in the centre of the track, at a distance from the signal-post, varying from the foot of the post itself up to 400 m. to suit the requirements.

Two fixed ramps are used, fig. 2. The first is placed at the origin of a "field of vision" determined for the signal; the second at the foot of the signal itself. In this way, the position of the disk will be known, not only when the driver passed the signal, but also when he passed over the first ramp on entering the "field of vision."

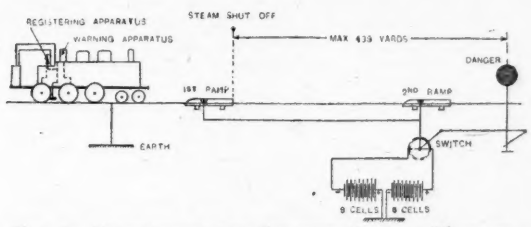


FIG. 2.—DIAGRAM OF THE ELECTRIC CIRCUIT (EASTERN RAILWAY).

The switch at the signal disk, which connects the two sets of batteries with the ramp, is in a cast-iron box. When the disk is at danger, the positive pole of one of the batteries is connected with the ramp. When the disk is at safe, the negative pole of the other battery connects with the ramp.

The warning apparatus is similar to the apparatus described for the Nord, but a horn is used instead of a bell-whistle. In order to provide for this an additional device called a Servo-motor is introduced, and in certain cases a second Servo-motor which brings the armature of the magnet back into position, so that the driver has nothing to do with the re-clutching and cannot stop the warning too suddenly.

A record is made on the tape of the speed-indicator itself (Flamand system). A third stylo-nib is fixed between the two others recording the time and the speed, and dots down the positions of the signals passed. The apparatus consists of two Hughes electromagnets with their poles reversed, so that one is demagnetised by a positive current and the other by a negative current. The two magnets are in series and join on at one end to the wire from the brush. The other end is connected to the engine and thence goes to earth. Under these conditions, supposing the disk is at "danger," one of the magnets will be demagnetised (the other keeping its armature), and the stylo will make a mark on one side of the normal line. If the disk be at "safe," the other magnet will be demagnetised, and a mark will be recorded on the other side of the normal line.

After experimental trials, the two batteries installed at the disk have been replaced by a single battery, each pole of which is connected alternately to the "ramp" and the earth.

The ramps described have been replaced by a ramp in the shape of a gridiron, and composed of bars or angle-bars parallel to the track. The object of this modification is to eliminate failure due to hoar frost.

Instead of a collector consisting of copper wires, a very rigid brush is used, made of steel blades with a section 1 mm. by 3 mm. These blades are made up in bundles of four. Their passage between the bars of the ramp scrapes off the hoar-frost, and a good electric contact is ensured under all conditions.

In future the release of the armature at the registering apparatus (signal being at "danger") will be used to work the warning apparatus, and the Servo-motor and corresponding electric circuit will be dispensed with.

The release of the armature at the registering apparatus sets a bell ringing when the engine passes a signal at "safe." The driver thus knows if his apparatus is in working order.

The apparatus used on the Chemins de fer du Midi was described by MR. A. HERDNER, locomotive and rolling-stock superintendent. The warning and registering apparatus, which is now being experimented with on 20 engines and 30 automatic signals, differs from the preceding, in that the battery is placed on the engine instead of on the track. Moreover, the original apparatus does not possess an appliance by which the driver's vigilance may be controlled.

The apparatus mounted on the engine consists of a metallic brush collector fixed on an insulated support under the rear platform of the engine; a special steam-whistle controlled by a Servo-motor; an electro-automatic contrivance fixed on the screen of the cab, and working, on a shaft, two special stylo pens of the Haushaelter speed-indicator, as well as the valve admitting steam to the Servo-motor of the warning whistle; an insulated conductor connecting the brush to the electro-automatic apparatus, which is itself earthed through the body of the engine and the rails; and an appliance controlled by a hand-lever within reach of the driver, and working one of the special pens of the speed-indicator.

The appliances mounted on the track comprise for each disk, an electric battery; a fixed ramp near the disk, insulated from earth, and connected by an insulated wire to one of the poles of the battery; and a switch disposed so as to establish the connection between the second pole of the battery and the rails when the disk is turned to "danger."

The moment the driver of a train sights a disk turned to "danger," he must immediately work the handle of the control apparatus, which then causes the special pen to trace a particular mark on the paper of the speed indicator.

When the engine arrives at the stop-signal, the collector rubs on the ramp, and the circuit becomes closed, on one side through the switch of the disk, and on the other through the brush in contact with the ramp. The current then passes through the electro-automatic apparatus and releases it, so that its shaft works simultaneously the two special pens of the Haushaelter indicator, and the steam valve of the Servo-motor. The two pens trace on the same vertical on the paper of the speed indicator two particular marks, which must follow the single mark made by the controlling device; the valve, admitting steam to the Servo-motor, sets the warning whistle going.

The driver stops this by pressing on the lever of the shaft, thereby closing the valve and bringing back the armature of the magnet, and thus closes the steam valve.

MR. A. CLAVEILLE, general manager of the State Railways, states that four safety devices are being subjected to comparative tests on the Chemins de fer de l'Etat. The Cousin system has been installed on 55 locomotives; it involves the use of a mechanical device actuated by a ramp, which is raised or lowered in accordance with the position of the signal disk. The device is used to operate a horn, and to close an electric circuit which actuates the recording apparatus, as on the Eastern Railway.

MR. L. MARECHAL, locomotive and rolling-stock superintendent of the Chemin de fer de Paris à Lyon et à la Mediterranée, said that he could not for the present make any definite statement regarding warning and signal-recording apparatus on the line, as these had but recently been fixed. Experiments were being carried out on 140 express locomotives and on 415 km. of double track with 316 disks fully equipped.

The warning and registering system was based on the combined use of electricity and compressed air, using switches and ramps similar to those adopted on other railways where the system was entirely electrical. In the Paris, Lyons and Mediterranean system, electricity comes into play, only to release the armature of the electromagnet of the relay and close a circuit on the engine itself, without doing any mechanical work. Through this local circuit of the electro-pneumatic relay (which is fed electrically from the battery on the engine and pneumatically from the receiver) being closed, compressed air becomes the agent which definitely provides the mechanical power required for unclutching and reclutching.

MR. E. SOLACROUP, locomotive and rolling stock superintendent of the Chemins de Fer de Paris à Orléans, stated that for more than 50 years the Orléans Railway had adopted a signalling system consisting of signals placed at a distance in advance of the danger point, the unclutching of which, when set at "danger," was revealed by the explosion of two cartridges placed automatically on the track when the signal was at "danger." These signals, which are placed at a great distance from the point they protect, are the order for "stop dead" when set at "danger."

If, on account of atmospheric conditions or a moment's inattention, a driver does not notice the stop-signal, he will be warned of its presence at the moment he passes the post by the explosion of the two cartridges.

This system has the advantage not only of warning the driver himself of the presence of a stop-signal but also the officials on the train; it therefore constitutes a safety device which is just as efficient as, if not better than, a locomotive-cab signal. There is no accident on record on the Orléans Railway due to a driver having passed a stop-signal.

LEGAL.

OVERHEAD WIRES IN ABERDEEN: POSTMASTER-GENERAL AND TOWN COUNCIL.

SHERIFF YOUNG has issued his award in the matter of the difference between the Postmaster-General and the Aberdeen Town Council with regard to the erection of overhead telegraph wires at Hardgate, deciding against the Council and finding that the Postmaster-General is at liberty to erect the overground line. For their unwillingness to agree to the proposed line the Council had put forward various reasons, and the position that they had taken up was in substance this, that an overground line would involve danger to the public, impede traffic, prejudice the amenity of the road, and depreciate the value of the property in the vicinity. The Sheriff held that there was no good reason to apprehend danger or obstruction. On the question of amenity and the objection which was founded on possible injury to it, his Lordship states that much has been said of the disfigurement caused to roadways by the presence of poles and wires; and one was readily disposed to be in sympathy with municipal authorities who were naturally and properly jealous for the appearance and pleasantness

of the roads under their charge. But unless the loss of amenity was truly of a serious kind, it could not be regarded as a consideration adequate to outweigh the importance of a general scheme. Continuing, the Sheriff said: As explained by the engineers who attended as witnesses, a trunk line was constructed mainly overhead, and it was essential for the efficient working of the system that this should be the construction as far as possible. There were serious objections to short sections of underground lines in combination with the open, and the effect of linking up the underground with the overhead wires was that the efficiency of the trunk service was impaired and reduced through what was known as electric induction and reflection. Besides, it was explained as a fact which was of importance in long-distance telephony, that the nearer the wire was to the earth the more inefficient was the wire, while on the overhead line the effect of the earth on the current was not so great. This evidence, said the Sheriff, as to the establishment of trunk lines went a long way to show that in relation to such services it was extremely desirable to restrict where possible the use of underground lines.

Marconi and Marconi's Wireless Telegraph Co., Ltd., *v.* Helsby Wireless Telegraph Co., Ltd.

(*Continued from page* 52.)

Dr. Erskine-Murray continued his evidence upon the day after the demonstration at the defendants referred to. The witness said that after the demonstration he photographed the spark in the primary current of the apparatus seen there, taking it by means of a revolving mirror running at as high a speed as could conveniently be got. He immediately took a resonance curve from the same circuit; the decrement amounted to 0·34, which indicated seven whole oscillations up to the point at which the amplitude had become one-tenth of the initial amplitude.

Mr. Jaffe (examining): What was the circuit you were actually testing?—The circuit was the primary of the apparatus at the defendants' at Lennox House, which is intended to represent approximately the ship's installation. The extra spark gaps were in.

Photographs of Sparks, showing Train of Oscillations.

How many oscillations does the negative taken from the sparks show?—One of these sparks shows about 18 half oscillations, about nine whole oscillations. That was a few more than the number given by the logarithmic decrement method.

Have you any inference to draw as to the sensitiveness of the spark?—That the spark photograph method usually takes in waves which are less than 10 per cent. of the initial amplitude in this case.

What was the installation like when you tried the first mirror experiment?—The installation was arranged in its ordinary working arrangement, with a choking coil connected, and the discharge gaps open. The spark was observed under those conditions. I then disconnected the aerial, and observed that the spark became longer, that there was less damping owing to the fact that no energy was being taken from the spark circuit. The next experiment was to attach the aerial again, and to put the aerial out of tune with the primary, in order to show a similar, though not quite so great, lengthening of the primary wave train. I then returned to the first condition, the working condition, and showed again the short wave train of the spark under working conditions.

That is to say you made three experiments, in each case starting with the working conditions, first showing that uncoupling the aerial lengthened the spark, and next that throwing out of tune lengthened the spark, and, thirdly, that removing the gaps and the choking coil lengthened the spark?—Yes. In the last experiment we showed very much longer wave trains.

Did the learned assessor point out anything about the load on the antenna when the ship was in the working condition, in the two positions of the last experiment?—He pointed out in the case in which the apparatus was working comparably with that of the ships, the antenna current was 0·9 ampere, and that in the case where the gaps were shorted, and the choking coil disconnected, the antenna current was 0·8, and, therefore, the energy in those two cases was in the ratio of 9 squared to 8 squared; in the case of the ship arrangement 81 and in the case of the gaps being shorted and the choking coil disconnected 64; so that there was more energy, though not quite the same ratio as we obtained by actual observation on board the ships.

Then was the further experiment carried out of short-circuiting the quenching gaps, leaving in the choking coil?—Yes, there was no appreciable effect that one could measure.

Would you expect any other effect?—No, because the other gaps were not in.

You would never suggest that a choking coil would have any effect when the gaps were cut out?—No.

Mr. Walter then cross-examined, taking the witness over the details of the installations on the ships. Witness stated that the aerial was not a vertical antenna, as specified in the 7,777 patent, but mainly horizontal; the vertical antenna had a very large decrement, and a good selective wave could not be obtained with a shock-excited antenna which had too large a decrement. The antenna was connected to earth through an auto-transformer, and means were provided for tuning the primary and secondary circuits; these were tuned together so that energy in one might build up the energy in the other.

What apparatus can you point to before the date of Marconi's 7,777 that did anything of the kind?—The Tesla apparatus.

Will you enumerate them all?—In Ducretet's experiment, if the Oudin resonator were used as an Oudin resonator, there would be tuning up.

The coupling of your primary and secondary are loose?—Comparatively.

Should I be wrong in suggesting that the percentage of the coupling is material in considering the speed of the transfer of energy from one circuit to another?—You would not be wrong in suggesting it, but you would be wrong in suggesting that the mere increase of coupling would accelerate the transference of energy; because if you have a short wave train there are a series of maximum best couplings, which are separated by stretches of coupling which are not so good if the primary has a short wave train.

During the time that the oscillations are going on in the primary, whether the spark gaps are there or not, the building up of the oscillations of the secondary is taking place?—Yes, as long as you kill your primary spark before that energy begins to return.

Your are, in fact, transferring the energy to the secondary and building up the energy in the secondary by oscillations in the primary?—During those two or three swings.

According to your view you cut off the oscillations in the primary. Have you got enough energy into the secondary by that time for the work you want to do?—Certainly.

Now, you adopt means at that moment to cut off the energy and to build up the secondary by the oscillations in the primary?—Yes.

But for the fact that you adopt means to cut it off, it would go on building up?—It might come back again.

Mr. Justice Eve: If the secondary was radiating, would it then come back?—It depends on the rate of radiation.

Mr. Terrell: If you did not quench it you might get Marconi.

Mr. Walter: What beneficial object can you suggest is attained by this?—The beneficial object of obtaining the natural wave of the antenna, and of excluding your waste of energy from your persistent circuit, the waste of energy in the spark; the antenna has now become the persistent circuit, and there is no spark in the antenna. In the other method there is a persistent circuit, the primary, in which there is a spark that lasts a considerable time and wastes considerable energy.

There is no spark in a Marconi aerial?—Certainly not.

You have a spark in your primary circuit, no spark in your secondary?—My primary circuit does not waste the energy to the same amount that the other spark wastes it, the persistent spark.

Having got over enough oscillations, do you mean that you have improved Marconi by cutting off the oscillations of Marconi when you have got it over, or what is it?—Most certainly I do. It is well known that shock excitation systems are 50 per cent. more efficient than any system that has a permanent primary.

Do I understand you to mean that in a single primary oscillating circuit it is possible to have only two or three oscillations?—It is possible to have half a one; that is to attain Lodge's ideal.

Where has the energy gone in your curve?—Into the secondary, as it was intended to do in that particular case.

That is, the whole of the energy has gone?—No, there is probably a little left.

You told us before that substantially all the energy has gone over?—All the energy that you can get over under these circumstances, obviously.

That is what I put to you, all the energy you could get over has gone over, but no more than would have gone over in the ordinary Marconi with the same coupling. You have identically the same amount over then as you would get in Marconi with the same coupling and the same swings. Do you suggest that you are going to get more energy over than you would in the ordinary Marconi coupling in the same number of swings?—I do not see what that has to do with it.

The Assessor: You say you would get a higher spark frequency with your quenched spark than without?—In general, one does. In Lepel's system you get up to 10,000 sparks per second.

Mr. Walter: You agree with Mr. Pletts that if you had a double wave transmitted you can have an aerial which will take the whole of the energy of the two waves?—I am afraid it is not a very efficient aerial.

If you had two you can use one instrument and have two stations, one of which will be in tune with one wave and one of which will be in tune with the other?—Each of these waves will have less energy than if you radiated on a single wave.

Assume you have a good radiating aerial, is it not the fact that if you want to transfer the energy rapidly you tightly couple?—Not essentially.

When you want to get it transferred very rapidly, is it the fact

that the more tightly you couple the more rapidly you get it over?—No, certainly not. The fact is, you would find the right coupling. If you increase the coupling, at times you might make the transference of energy less rapid.

Will you give an example in which you say you hasten it by loose coupling?—If I take these ship installations and couple them up too tightly, the energy will be certainly transferred to the aerial, but it will come back again.

MR. WALTER: Do you suggest that the experiment you showed my Lord yesterday was a fair representation of the conditions on board the ship?—It was a fair representation in the sense that an artificial antenna was used instead of the real one.

Was it a fair representation from the point of view of the sparks we saw?—They were not so highly resolved as the ones I saw on the ship; we were not running the mirror at so high a speed.

Did the photographs you showed us show beats?—No. We, I believe, showed you beats in the case where the gaps were shorted, and the discharge coil was off.

There were beats, that is to say, at the time it was working as an ordinary Marconi?—It was an imitation of an ordinary Marconi.

You do not suggest that would not be working exactly in accordance with the 7,777?—That is a different thing from the Marconi conditions.

As it was working then, there was nothing that could distinguish them from the ordinary Marconi?—It was practically indistinguishable.

The ASSESSOR: I think you said that the effect of opening the spark gaps was to give you higher spark frequency?—I believe so. It should be so.

You would hear that if you were listening at the receiving end?—You would hear a slightly different tone in your telephone.

It detects group frequency?—Yes, it is the group frequency which determines the telephone tone.

MR. WALTER: I have understood it to be said that the defendants' is Lodge. Do you say that is the case?—I cannot see how I can answer yes or no to that. You have to define Lodge first.

No, I have not. Do you say the defendants' is Lodge?—I say that the defendants' apparatus is constructed according to Lodge, Fig. 4, with that central gap left out, and as it happens in the present arrangement with one of the condensers left out, and with a different shape of antenna from what is in Lodge.

Do you know the theory upon which Lodge works?—The only satisfactory way in which I can know the theory upon which Lodge works is to make the apparatus as nearly as possible to Lodge's specification and then to find out how it works.

Have you done so?—This apparatus on the *Cambria* and the *Scotia* is made as nearly as I can see to Lodge's specification.

Then in order to be quite clear you do say that the defendants' is Lodge?—With the qualifications I gave.

Is there any hint or suggestion in Lodge of two circuits, one of which inductively acts on the other?—Most certainly.

Had anybody before Marconi, and before the 7,777, suggested the use of two circuits with a common inductance between the primary and the secondary, an inductance in the aerial, the two being capable of being tuned together for wireless telegraphy?—I think Braun's patent, one of them, is dated before.

No further evidence was called for the defendants, and at this stage the hearing was adjourned until Monday, July 13th.

On resuming Counsel for the respective parties summed up the case, the hearing of which was concluded on Tuesday. MR. JAFFE summed up the case for the defendants, and MR. WALTER, K.C., replied on behalf of the plaintiffs.

At the conclusion of the arguments, his LORDSHIP reserved judgment.

POSTMASTER-GENERAL *v.* DARLINGTON CORPORATION.

IN the Railway and Canal Commission Court on July 8th, Mr. Justice Banks, the Hon. A. E. Gathorne Hardy, and Sir James Woodhouse heard the appeal of the Postmaster-General against the refusal of the Corporation of Darlington to allow him to erect a distributing telegraph and telephone pole in a thoroughfare at Darlington.

MR. FRANK RUSSELL, who appeared for the Postmaster-General, said the case was of some importance because it affected a matter of public policy. It appeared that a pole holding a number of wires stood for a long time in a yard owned by Ald. Benson, of Darlington, for which the Postmaster-General paid a rent of 10s. annually. Mr. Benson raised the rent to £3, which was considered to be preposterous, so the Postmaster-General, exercising his right under the Telegraph Acts, asked the sanction of the Corporation to erect the pole on the edge of the pavement of Northumberland Street. The Council objected on the ground that the pole would be an obstruction to the public, a danger, and an extra expense on the rates, because it would entail extra lighting of the road by night. The Postmaster-General received an offer—which was probably prompted by the Corporation—from a Mr. Blackett, that the pole should be placed in his yard at a rental of £1 a year, with three months' notice to terminate the agreement, but the Postmaster-General objected to the length of notice, as it gave him no security of tenure. The Postmaster-General, continued counsel, always endeavoured to place telegraph and telephone poles on the highways, because of the easy access that was afforded for repairs, and in addition he objected to so many private rentals. At the present moment he was paying £118,000 a year for private rentals. Counsel said he could prove that the contention that the post would be a danger and an obstruction could not prevail, for the post would be placed against a wall, leaving the pavement free, and there would be no stays or supports.

Evidence was given by MR. J. K. ELLIOTT, superintendent engineer for the Northern district, who said the Postmaster-General objected to so many private wayleaves because of the great expense and the difficulty of gaining access for quick repairs. Replying to counsel for the Corporation, he agreed that the Corporation had been very reasonable and had allowed 149 poles to be erected in the streets.

Counsel: And you think they are unreasonable over the 150th pole?—Yes.

MR. WM. SLINGO, engineer-in-chief to the Post Office, said that the Post Office had 1,665,000 poles, for which they paid rentals, and some payments, he considered, were exorbitant. They objected to pay the rent demanded by Mr. Benson, because they thought they should save the rates.

Counsel: And to save the rates you fight this small matter out in the High Courts?—We do.

After MR. H. G. STEVENSON, town clerk of Darlington, had given evidence, stating that the Council did not wish to be unreasonable, the Court dismissed the Postmaster-General's appeal, SIR JAMES WOODHOUSE observing that he thought the Post Office had, in this case, adopted an attitude such as should not be taken up by a Government Department.

VANDAM *v.* ARMORDUCT MANUFACTURING CO., LTD.

IN the City of London Court, on Tuesday, before his Honour Judge Atherley-Jones, K.C., an action was brought by Mr. Albert Vandam, commission agent, Caxton House, S.W., who made a claim against the Armorduct Manufacturing Co., Ltd., for £5 15s. 8d. commission due at the rate of 2½ per cent. on certain electric cable supplied by them to Mr. Kerr, South Africa. Mr. Hurd appeared for the plaintiff and Mr. G. E. Tong for the defendants.

MR. HURD stated that the plaintiff was an agent for electrical accessories, and in the course of his business he visited foreign countries throughout the world and came across various orders which firms wanted to place in this country. In September, 1911, plaintiff knew a Mr. Kerr, of Johannesburg, South Africa, who wanted to place large orders for electrical cables. Plaintiff went to the defendants and asked them if they would undertake the business with Mr. Kerr. An agreement was made between the parties by which the defendants agreed that if plaintiff introduced Kerr to them they would pay him a commission of 2½ per cent. on all business resulting from the introduction. It was mentioned that the commission would be payable so long as business continued to be done between plaintiff and defendants. A further letter was written in November, by which the defendants rendered a monthly statement of the account showing that it was a continuing account. Defendants had been continuing to supply electrical goods to Mr. Kerr, and had sent proper statements to the plaintiff of the goods so supplied, and had been paying him his agreed commission at 2½ per cent. Last year a difficulty arose. Defendants thought that instead of paying 2½ per cent. they would pay half of it. Plaintiff refused to accept that, and defendants paid the plaintiff at the full rate. Now defendants had sent in an account showing that Kerr had given orders for £231 worth of goods, and they had paid into Court £2 17s. 10d., being 1¼ per cent. commission instead of 2½ per cent. Plaintiff could not understand why. Defendants now said that a year ago they told the plaintiff they would reduce the commission. That was a one-sided contract. Defendants suggested that the orders came to them through shipping agents, which had nothing to do with the plaintiff. Defendants could not get rid of their obligation under the first contract.

MR. TONG said that a subsequent contract was made with Mr. Kerr.

JUDGE ATHERLEY-JONES could not see how that affected the plaintiff.

MR. TONG said that Kerr started dealing direct with the defendants, and plaintiff had 2½ per cent. commission. Kerr then sent his orders through Hales, Caird & Co., and plaintiff's commission was not due. There was nothing to identify Kerr's orders that came through Hales, Caird & Co.

MR. HURD said that as the defendants had paid half the commission into Court, defendants were out of court. That was an admission *pro tanto* with the contract sued on. The only question was whether it was 1¼ per cent. or 2½ per cent. Plaintiff said he never agreed to vary the rate of commission.

DEFENDANTS' secretary said that where Kerr's business came to them through Hales, Caird & Co., no commission became due to the plaintiff.

JUDGE ATHERLEY-JONES found for the plaintiff, with costs, and said that an agreement to pay 2½ per cent. had never been varied with the consent of the plaintiff.

A Lightning Sketch.—Whilst a servant girl was cleaning a window of a house in Toronto, a flash of lightning passed, leaving the imprint of her hand on the glass. We are informed that the fingers and wrist were quite plainly to be seen on the glass, and heavy rubbing failed to remove the imprints. Other details are lacking.

BUSINESS NOTES.

Catalogues and Lists. — THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Illustrated priced leaflet describing various speed or revolution counters. Also G.E.C. Bulletin No. 1, a revised list of important plant. This is a 52-page publication, the contents of which consist almost entirely of photographic reproductions of turbo-alternators, continuous current generators, rotary converters, motor-generators, switchboards, &c., supplied for power and sub-stations in this country and abroad, and for collieries, breweries, steelworks, &c. The pages of motor installations show colliery haulage gear, shipbuilding equipments, &c. Some pages at the end of the book are filled with tabulated particulars of such plant and the destination of same.

THE STURTEVANT ENGINEERING CO., LTD., 147, Queen Victoria Street, London, E.C.—Leaflet No. P. 1,391 shows some of the company's specialities for picture theatres, including their air washer, air turbine vacuum cleaner, and propeller fans.

MR. H. MOSS, 116, Horton Grange Road, Bradford.—We have received a batch of publicity literature which is being used by Mr. Moss as ammunition in connection with a determined advertising campaign which he has in progress and will have for the next few months, boosting electric suction cleaners, electric fans, flat irons, domestic heating and cooking apparatus, and telephone message counters.

MESSRS. STEINBACH & HOHN, 669, Mansion House Chambers, Bucklersbury, London, E.C.—48-page catalogue of electrical accessories (lampholders, hand lamps, adapters, wall plugs, ceiling roses, tumbler and other switches) made by Messrs. F. W. Busch Aktien-Gesellschaft, of Lüdenscheid, for whom they are agents.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—List No. 4,202 describes B.T.H. automatic circuit-breakers with magnetic blow-out, and gives prices and dimension drawings of same. Twelve-page list (No. 2,270) describing continuous-current crane motors with detailed tables of ratings. List No. 4,610 (24 pages) particularises and prices porcelain parts stocked by the company and used in connection with B.T.H. standard apparatus.

ALLGEMEINE ELEKTRICITATS - GESELLSCHAFT, Berlin. — Brochures relating to the electric driving of waterworks and drainage installations, high-pressure cables (up to 60,000 volts), automatic domestic water-pumps, cast-iron installation-material for railway workshops, and measuring instruments (recording).

MESSRS. WAKELINS, LTD., 5 and 7, Tottenham Street, Tottenham Court Road, London, W.—Thirty-two-page illustrated price list of plant and apparatus for country house lighting installations—small combined electric lighting sets, electric light fittings, electric sets for cinematograph work, "Hydrobenoid" pumping plant with automatic electric motor, &c. A separate 10-page list shows examples of the firm's art metal work for gates, railways, illuminated signs, &c.

THE KORFUND CO., 431, Bank Chambers, High Holborn, London, W.C.—New illustrated circular detailing the merits and purposes of "Korfund" as a vibration and noise preventer.

MESSRS. R. H. PATTERSON & CO., LTD., Forth Street Works, Newcastle-on-Tyne.—July stock list of new and second-hand machinery.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., 109-111, New Oxford Street, London, W.C.—Sixteen-page illustrated list (No. PM 12) giving tabulated details and prices of high-tension oil switches, oil switch fuses, isolating switches, H.T. fuses, lightning arresters, relays, switch pillars, &c.

BRITISH PROMETHEUS CO., LTD., Salop Street Works, Highgate, Birmingham.—Non-technical leaflet, entitled "Ironing by Electricity," giving information for the domestic user regarding the various points of superiority possessed by the electric iron. Contractors and others can have supplies of copies over-printed with their own names.

THE ELECTRICAL CO., LTD., London.—The *E.C. Journal* for June: also leaflets relating to small motors and dynamos for driving wireless telegraph models, and to new type liquid starters.

MESSRS. FELD BROS. & CO., LTD., 25, Budge Row, London, E.C. —Twenty-page booklet (No. 250) respecting their various insulating materials—mica, micanite, Carta material, asbestos press materials, insulating cloth, insulating varnishes, enamelled wire and ready-wound coils.

MESSRS. MATHER & PLATT, LTD., Manchester.—Finely-produced catalogue of 24 pages, illustrating in excellent style, and describing the construction of, the firm's high-lift turbine pumps and other pumps for various classes of service. A companion pamphlet gives a full list of collieries which are using the M. and P. high-lift turbine pumps.

MESSRS. POPE'S ELECTRIC LAMP CO., LTD., Hythe Road, Willesden.—New 16-page catalogue of Pope carbon-filament lamps, of British manufacture. Full sized drawings of the lamps appear, together with particulars of candle-powers, voltages, dimensions and prices of various shapes and types—standard, traction, ships' side-light, tubular, fancy battery, crinkled flame, radiator, resistance and coloured glass.

MESSRS. ALFRED HERBERT, LTD., Coventry.—The July issue of the "Monthly Review of Modern Machine Ship Practice" contains admirably illustrated articles on high-power milling machines, steel bars, truing grinding wheels, continuous milling, selling guarantees, and other subjects, as well as a monthly stock list of machines.

PITTER'S VENTILATING AND ENGINEERING CO., LTD., 20, Bishopsgate, London, E.C.—Appropriate to these July days is a remark on a folder from this company to the effect that there's a commercial value in keeping cool. Inside are given illustrations and prices of the firm's "Multiblade" type electric fans.

BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, London, E.C.—For the convenience of aluminium users the company have issued for hanging on the wall a sheet of tabulated matter relating to aluminium tube, sheet, wire, bar and strip, strand, round rod, alloys, &c.

EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., Ponder's End.—Advance copy of eighth edition of Section IX Catalogue (Part 2) of 40 pages, giving illustrated matter and prices relating to Ediswan telephones and accessories, domestic telephones, telephone arms, battery ringing and magneto wall 'phones, "Primax" and magneto interphones, lamp signalling, mining telephones, electric blasting machines, &c.

MESSRS. WHITTAKER & CO., 2, White Hart Street, E.C.—Catalogue of scientific and technical books for 1914.

Dissolutions and Liquidations.—BRITISH POWER CO., LTD.—At a meeting on June 24th, a resolution was passed to wind up the company voluntarily.

E.M.F., LTD.—A meeting will be held at 57, Moorgate Street, E.C., on August 17th to hear an account of the winding up from the liquidator, Mr. G. Little.

CHEAP POWER SUPPLY AND ENGINEERING CO, LTD.—A meeting will be held at the offices of Messrs. Grover, Smith & Moss, 77, Fountain Street, Manchester, on August 20th, to hear on account of the winding up from the liquidator, Mr. W. T. Green.

CONSOLIDATED DIESEL ENGINE MANUFACTURERS, LTD.—An order was made last week at the London Bankruptcy Buildings, appointing Sir William Peat, chartered accountant, special manager to conduct the business pending the statutory first meeting of the creditors and shareholders.

FELL & JAMES, consulting engineers and chartered patent agents, 1, Queen Victoria Street, E.C.—Messrs. J. C. Fell & R. W. James have dissolved partnership. Mr. James attends to debts and continues the business under the same style.

THE "DAC" ACCUMULATOR SYNDICATE, LTD.—A meeting of creditors is called for July 24th, at the offices of Messrs. Chantrey, Chantrey & Co., 61-62, Lincoln's Inn Fields, W.C., by the liquidator, Mr. H. C. Bound.

ISAAC STOREY & SONS, LTD.—With reference to the paragraph in our last issue respecting this company, we are asked to state, in order to avoid giving a wrong impression, that Isaac Storey and Sons, Ltd., went into voluntary liquidation for the purposes of amalgamating with United Brassfounders and Engineers, Ltd., Empress Foundry, Cornbrook, Manchester, in 1910.

Trade Announcements.—MR. D. NEILL-KEITH has been appointed switchboard representative for Messrs. Ferranti, Ltd., for the Lancashire district and Ireland.

THE SCHNIEWINDT ELECTRIC CO., 40 and 41, Staniforth Street, Birmingham, have appointed Mr. Wm. Riley, 3, Haydon Street, Minories, London, E.C., as their sole London and district agent for their electrical resistance materials, &c. A stock of nets, wire, &c., will be held at his address.

THE VALOR CO., LTD., have rearranged their offices at 120, Victoria Street, S.W., adapting them for the display of chemical fire extinguishers, oil cabinets, oil filters, E.P.S. electric lighting sets for motor vehicles, &c. Readers are invited to call.

MR. A. E. GOODMAN, electric goods dealer, 60, Herbert Road, Plumstead, S.E., announces that he is giving up business.

MR. J. G. BOMFORD, late of Ellis & Ward, Ltd., Birmingham, has commenced business as an electrical engineer and contractor, at Shakespeare Chambers, Stratford-on-Avon.

Annual Outings.—On Saturday, July 4th, a large number of the employés of MESSRS. LAURENCE, SCOTT & CO., LTD., of Norwich, held their annual outing, the party dividing up into three sections. The main body (about 170) joined forces with the Norwich Corporation outing, making London their objective, where, thanks to an early start, a long day was available. About 50 travelled to Brighton by the Norwich Workers' outing, and a further contingent of about 70 made a circuitous road journey to Great Yarmouth. All those taking part in the outing greatly appreciated the action of the directors in generously contributing towards the day's expenses. The arrangements were in the hands of a joint committee, comprising Messrs. Bacon, Francis, Hammond, Jefferies, Johns, Rix and Webster, with Mr. H. Minister as hon. secretary and treasurer.

The 12th annual trip of the Potteries district of the BRITISH ELECTRICAL FRIENDLY SOCIETY recently took place, the parties consisting of just over 200, divided between the two days. A visit was paid to Liverpool.

The 14th annual outing in connection with the recreation club of the ST. HELENS CABLE AND RUBBER CO. took place recently, 450 employés and friends spending an enjoyable day at Blackpool.

On Saturday, July 4th, the LINOLITE CO.'S office and works staffs went for their annual outing, travelling from Victoria Station to Herne Bay. In favourable weather the party, after indulging in boating and swimming, partook of luncheon at the Tea Gardens on the Lees. In the afternoon, tennis, bathing and rambles were enjoyed by various members of the party. Tea was served on the lawn of the above gardens. Mr. A. S. E. Ackermann, the company's engineer and manager, and Mr. R. L. Matthews, the assistant manager, were both present, together with Mrs. Ackermann and family.

The BRIMSDOWN LAMP WORKS held their annual outing on Saturday last, when the staff and employés and a number of friends travelled to Great Yarmouth. At the luncheon, which was served at the Arcade Restaurant, Mr. Scharrer proposed the health of the managing director, Mr. Reiss, who suitably responded, thanking the workers for their co-operation and support. He said that the company had made steady progress during the past year, and trusted that they would continue their course along the road of progress.

The employés of the KINGOLITE CO., LTD., and W. B. COUPIER had their first annual excursion on Wednesday, July 8th. The party, numbering between 50 and 60, went by train from Waterloo to Windsor, where they embarked on the S.L. *Countess* for Marlow. Luncheon and tea were served on board, and the musical programme was provided by the employés. Responding to the toast, "Success to the Company," Mr. Owen, the managing director, said he felt sure that they were doing business on the right lines, and with the continued co-operation of the staff, they were bound to make their presence felt in the trade. On the following morning, the forewoman, Mrs. Palmer—who was unable to be present at the excursion—was presented with a gold bracelet watch, suitably inscribed, and Mr. Owen, in making the presentation, said that he hoped Mrs. Palmer would preside over the works for many years to come.

Book Notices.—We have received from the Port of London Authority an extremely interesting and instructive brochure of about 100 pages, dealing with the past and present history of the Thames and its docks. The letterpress is by Mr. Douglas Owen, and the illustrations, which are numerous and artistic, and in a number of cases in colours, are by Mr. Charles J. De Lacy. The book briefly traces the rise of the Port of London from its earliest days, and relates the circumstances which eventually led up to the creation of the Port of London Authority. The first enclosed dock area was the Howland Dock at Rotherhithe, which flourished as early as 1703. Its site now forms part of the Surrey Commercial Docks. It was, however, nearly a century later that the value of enclosed docks for the handling and protection of cargo came to be fully appreciated, and the West India Dock, the precursor of many others, was opened for trade with the active support of the great William Pitt. In addition to dealing with the many-sided activities of the Port Authority, the book deals fully with their great scheme of improvements now in course of execution, and in particular indicates by pen and picture the general character and importance of the fine new deep-water dock which is now being constructed between the Royal Albert Dock and the river. Several of the illustrations effectively suggest the great part which the enterprise is likely to play in the future commercial history of London.

"The Physical Society of London: Report on Radiation and the Quantum Theory." By J. H. Jeans. London: The *Electrician* Printing and Publishing Co., Ltd. Price to non-fellows, 6s. 8d. net.

Ragged-Staff Rhymes. By A. Sedgwick Barnard. Birmingham: Cornish Bros., Ltd. Price 6d. net.—This little collection of poems is from the pen of a well-known central-station engineer (who, by the way, has just abandoned municipal work for a commercial career); the verses are mainly cast in a melancholy vein, but they are charged with the true poetic fire, and are well worth perusal. Some of them hang in the memory in mournful cadence—one in particular, obviously inspired by the *Titanic* disaster, pays a noble tribute to the heroic engineers who did their duty to the last without thought for their own safety. We hope the versatile author will continue to produce "Ragged-Staff Rhymes," for which he possesses a marked aptitude.

Boksburg Railless Trolley.—With reference to the article on the Boksburg, Transvaal, railless trolley system, which appeared in our issue of April 24th, 1914, we are informed that the contract for the supply, delivery and erection of the whole of the converting machinery and switchgear in the converter station was carried out for the Boksburg municipality by MESSRS. S. SYKES & CO., LTD., of Johannesburg. Messrs. Sykes are the sole representatives of Messrs. Bruce Peebles & Co., Ltd., and also of Messrs. A. Reyrolle & Co., Ltd., with which companies they placed the orders for the two Peebles-La Cour motor-converters and the H.T. and L.T. switchgear respectively. The erection was carried out by Messrs. Sykes under the supervision of their chief electrical engineer, who, incidentally, happens to have been connected in the past for a considerable period with Messrs. Bruce Peebles and Co., Ltd.

Rubber Wires and Cables.—THE LIVERPOOL ELECTRIC CABLE CO., LTD., of Bootle, announce reductions in the prices of their rubber-insulated wires and cables, consequent upon the continued low price of materials. Altered discounts are announced for prices given in their January, 1914, list of Association and non-Association qualities.

Bankruptcy Proceedings.—CHAS. HENRY KITCHING, 172, Beverley Road, and 42, Chariot Street, Kingston-upon-Hull, electrical engineer, &c.—This debtor applied to his Honour Judge Fossett Lock at the Guildhall, Hull, last week, for his discharge from bankruptcy. The debtor failed in October, 1898. The Official Receiver stated that the debtor estimated his liabilities expected to rank for dividend at £2,283, of which £465 was due to four moneylenders. The assets realised £821, the difference being accounted for mainly by the debtor having considerably overestimated the amount likely to be realised from his stock-in-trade and book debts. The balance available for costs and distribution amongst the unsecured creditors was £713, instead of £136, estimated by the debtor, and a dividend of 2s. 9d. in the £ was paid. Debtor's premises were styled the City Electric Light Works. He commenced in May, 1896, with no capital, obtaining a loan of £200 from a moneylender. No trading or profit and loss accounts were kept, and no balance-sheet was got out until July, 1898. Debtor was then shown to be on the wrong side, and he executed a deed of assignment, an act of bankruptcy on which the receiving order was made. Mr. Harry Wray, the debtor's solicitor, said the debtor was a man of a very sanguine temperament, and he had allowed his ambitions to over-ride his discretion. He embarked very largely in trade taking contracts and buying large stocks, especially of electrical appliances, which at that time were becoming very much in request. Replying to his Honour, Mr. Wray said that the debtor was now in Sheffield. There was no opposition to the application, and he submitted the debtor had been already sufficiently punished. Debtor was granted his discharge, subject to a two years' suspension.

FRANK HERBERT WATTS, electrical engineer, 40, Mincing Lane, E.C.—Under a receiving order made on June 25th, against this debtor upon the petition of Veritys, Ltd., creditors for £209, the statutory first meeting of creditors was held on July 9th, at Carey Street, W.C. Mr. Egerton S. Grey, Official Receiver, who presided, said that, according to the debtor's statement, he was an electrical engineer. Until the year 1901 he was engaged as a marine engineer, but in that year began as an electrical engineer in partnership; in 1904 there was a dissolution, and the debtor afterwards traded alone until April last. He was then compelled to execute a deed of assignment. He attributed his failure to loss on contracts, to insufficient capital, and to the loss of £200 in connection with a company. The debtor had lodged a statement of affairs showing liabilities £725, and assets consisting of cash, £72, in the hands of the trustee under the deed, and book debts £92. There was no offer of composition before the meeting, and the Official Receiver said that the Court had already adjudged the debtor a bankrupt. No resolution was passed, and the estate remained in the hands of the Official Receiver as trustee for administration.

G. BURGESS, electrical engineer, 27, Museum Chambers, W.C.—Receiving order made July 7th, on creditor's petition. First meeting, July 23rd; public examination, August 25th; both at Carey Street, W.C.

Electric Mains Explosions.—Referring to the recent inquiry into the causes of explosions on electric mains, and our comments on the report, with which they are in general agreement, the DUSSEK BITUMEN CO. write to us stating that they drew the attention of the Committee to the danger arising from the fumes and gases given off by the burning of the vulcanised bitumen insulation of the cables, which they consider much more serious than that due to gases from the ordinary refined bitumen used for filling the troughing. We pointed out that although the report made it clear that all serious explosions in houses had occurred in connection with vulcanised bitumen cables, it was tacitly assumed that the whole of the danger arose from the bitumen filling. As manufacturers of both vulcanised bitumen and ordinary refined Trinidad bitumen, the company think they could have given the Committee useful information if they had been invited to give evidence. They point out that bitumen "leaves the Court with an enhanced reputation," the continuance of its use being approved of by the Committee, and its superiority to pitch, which becomes soft in summer and brittle enough to crack in winter, whereas bitumen never softens and never cracks, is demonstrated also as regards the danger of explosion by the evidence of Dr. Wheeler, which we reproduced in our last issue. We understand that in none of the cases of explosion dealt with by the Committee was the bitumen manufactured by the Dussek Co.

Holidays.—Another new holiday handbook, entitled "Evenings by the Sea," has been issued by the GREAT EASTERN RAILWAY, depicting by means of water-colour sketches, some of the attractions of the 20 seaside resorts served by the company. Copies can be obtained from the Superintendent of the Line, Liverpool Street Station.

The works of the RECORD ELECTRICAL CO., LTD., will be closed from Friday, July 31st, until Monday, August 10th, for the annual holidays. Letters of extreme urgency will receive attention.

The works of the MIDLAND ELECTRIC MANUFACTURING CO., LTD., Birmingham, will be closed from Friday, July 31st, until Monday, August 10th, for the annual holidays.

The works of MESSRS. W. A. STEVENS, LTD., Victoria Works, St. Peter Street, Maidstone, will be closed for the summer holidays from August 1st to Monday, August 10th.

MESSRS. ELLIOTT BROS., Lewisham, announce that their works will be closed from July 30th to August 8th, inclusive, for the holidays.

For Sale.—MESSRS. P. HUDDLESTON & CO. have been instructed to sell by auction, on July 23rd, at Dalling Road, Hammersmith, W., a large quantity of electrical apparatus, including motors, switchboards, &c. The Directors of the Empire Theatre, London, W.C., invite offers for an electrolier, 178 lamps. Particulars are given in our advertisement pages to-day.

LIGHTING and POWER NOTES.

Ashton-under-Lyne.—EXTENSION OF SUPPLY.—The Standing Sub-Committee of the T.C. is to consider the question of supplying electricity to the Hurst Council.

Australia.—The financial statement of the Sydney (N.S.W.) City Council's electrical undertaking for the year 1913, shows a revenue of £285,743, and a total gross profit of £163,116. After meeting interest and sinking fund charges £98,712, depreciation, &c., £45,413, the surplus balance remaining was £53,299, or including certain balances brought forward, a total of £55,243. During the year 14,964,034 units were sold for lighting, and 17,022,809 units for power.

The Lane Cove Municipal Council, North Shore, Sydney, whose lighting contract with the North Shore Gas Co. expires at the end of 1915, has decided to enter into a contract with the Sydney City Council for the supply of electricity for a period of 10 years, commencing January 1st, 1916. The Council has also given the Sydney City Council permission to erect at once the necessary appliances for electric lighting purposes in connection with the supply to the other municipalities, and this will enable the City Council to carry its mains when necessary from Willoughby across Lane Cove into Mosman and North Sydney.

Barmborough.—PUBLIC LIGHTING.—Electricity for lighting the village is now being supplied by the Manvers Main Colliery Co., and an extension is to be made to Harlington.

Bedford.—NEW LOANS.—The T.C. is applying to the L.G.B. for sanction to a loan of £8,300 for E.L. mains for three years. The result of the last year's working of the electricity undertaking was a surplus of £511; the units sold numbered 2,649,080.

Boston.—PROV. ORDER.—The R.D.C. has been informed by Mr. Robert A. Smith that he intends applying to the B. of T. for a prov. order for electric supply within the area of the Council.

Bradford.—YEAR'S WORKING.—The report of the year's working of the electricity department shows a profit of £14,900. The income was £144,000, as against £130,000 last year, the increase being equally divided between lighting, power, traction and bulk supplies. The cost of generation was £39,000, equal to ·335d. per unit, which compares with ·345d. in the previous year; the cost of coal increased by £3,000. The gross profit was £75,000, £14,900 being left after payment of £22,000 interest on loans and contributing £38,000 to sinking fund. From this profit £7,000 has been spent on capital works outside the borrowing powers, and £5,000 has been devoted to relief of rates, leaving £2,900 to carry to reserve and renewals account, which amounts to £22,400. A total of 28,000,000 units were sold during the year, as compared with 24,500,000 in the previous year. The consumers increased from 3,600 to 4,100.

The city architect is to prepare a scheme and estimate for the lighting of the Technical College hall on modern lines; both the electricity and gas departments of the Corporation have been requested to supply estimates.

Buckie.—PROPOSED E.L.—Mr. Hogarth, of Edinburgh, has conferred with the Lighting Committee of the T.C. with reference to a scheme for the electric lighting of the town.

Chester.—YEAR'S WORKING.—The Corporation electrical department during 1913-14 sold 2,531,709 units, including 378,158 for the tramways and 640,076 for bulk supplies; the total compares with 2,372,393 units in the previous year. The total revenue amounted to £24,251 and the balance to net revenue to £12,950; after meeting interest and sinking fund charges, £1,094 was contributed in aid of the lamp rate, £500 to "city improvements," and £3,347 to reserve. The reserve fund in hand amounts to £13,733; some £3,339 was transferred during the year for capital expenditure, bringing up the total amount of capital expenditure defrayed from revenue to £18,020. During the year the hydro-electric scheme has contributed a considerable proportion of the output, and it may be noted that the works and management costs were ·839d. per unit as against ·889d. in the previous year, the coal item dropping from ·331d. to ·281d. per unit.

Coleraine.—E.L. PROPOSALS.—The Urban Council has received reports on the relative merits of gas and electricity from Mr. Langlands, Glasgow, and Mr. May, Londonderry. The matter has been deferred.

Continental Notes.—GREECE.—A scheme is reported to be under consideration for the establishment of a central electric lighting station in the town of Mitylene.

HOLLAND.—In connection with the approaching completion of the overland central station near Groningen, which is to supply the three northern provinces of Holland—Groningen, Drenthe and Friesland—with current for lighting and power purposes, arrangements are in hand for the holding of an electrical exhibition in the town of Groningen during the month of September next.

TURKEY.—A scheme is under consideration for the establishment of a central electric station in the town of Cavalla; a project has also been drawn up to utilise certain available water-power at Vodena in the generation of electrical energy for lighting and power purposes in the district.

GERMANY.—The Berlin suburb of Lichterfelde has made a 30-year contract with the Berlin electricity works to purchase energy in bulk for distribution. The company apparently supplies all the electrical plant, mains, &c., which may be purchased by the Council at an agreed time. The Council fixes the prices to be charged.

Coxhoe (County Durham).—STREET LIGHTING.—The Kelloe Colliery Co. has offered to light the district for £2 per post of two 25-C.P. lamps, the Council to provide poles, labour, &c., and connect to the company's plant. In addition the Colliery Co. reserves the right to supply current to private customers.

Crayford.—The West Kent Electric Co., Ltd., has applied to the B. of T. for consent to overhead lines for the supply of current at a pressure of 10,000 volts to Messrs. Vickers' works.

Criccieth.—STREET LIGHTING.—The Council at a special meeting, last week, decided in favour of electricity for lighting the streets, at an estimated cost of £5,500. It was stated that a gas lighting scheme would cost £9,000.

Douglas (Isle of Man).—A L.G.B. inquiry was held last week into the application of the T.C. for loans of £1,700 for the electric lighting of the sea front at Douglas, and £600, balance of the cost of the E.L. installation at Villa Marina.

Dublin.—L.G.B. INQUIRY.—Mr. P. C. Cowan held an inquiry on June 7th into the application of the T.C. for sanction to loans of £77,800 for electrical extensions, and £5,000 for the conversion of public lighting from gas to electricity. A large portion of the former loan is for switchgear and mains, while £30,000 is set apart for short extensions, services, &c. It was agreed that only half the street lighting loan should be taken up now; it is intended to adopt the Barrow suspension lighting system in certain streets, with an overhead feeder along the street.

Ealing.—SHOW ROOM.—The Electricity Committee has decided that Ealing contractors shall have facilities to use the new show room at the Town Hall; any contractor may purchase fittings at cost price plus 5 per cent., and commission will be paid to any Ealing contractor who introduces a customer for hiring fans, heating and cooking apparatus, or outside arc lamps, at the rate of 10 per cent. on net value up to £1 and 5 per cent. for higher values.

Easingwold.—E.L. SCHEME.—The U.D.C. has approved an amended agreement with Mr. Chas. H. Best, of Bradford, for an electric lighting scheme for Easingwold.

Glasgow.—The first section of the new Dalmarnock generating station is to contain one 15,000-KW. and two 10,000-KW. turbine units, with boiler houses, in three floors, placed at right angles to the turbine room. It is stated that the plant will not be ordered for six months.

Gravesend.—YEAR'S WORKING.—The accounts of the electricity undertaking for the year ended March 31st last show a profit, after payment of instalments of loans and interest, of £1,158.

Great Harwood (Lancashire).—PROPOSED E.L.—The D.C. is endeavouring to arrange for the Electricity Committee, the engineer, Mr. Watson, and the Rishton U.D.C., to interview the Blackburn E.L. Committee to discuss terms for the supply of electricity to the town.

Grimsby.—NEW BATTERY.—The electrical engineer has reported to the Electricity Committee in connection with the extensions next year, the necessity to install a new battery with booster, &c., the cost of same with the building being estimated at £5,000. It has been agreed to reduce the price for street lighting from £3 12s. 10d. to £3 per lamp.

Guisborough (Yorks.).—E.L. SCHEME.—The U.D.C. has engaged Messrs. May & Hawes to prepare a scheme for the supply of electricity in the district.

Heckmondwike.—YEAR'S WORKING.—The annual report of the electricity undertaking is not as satisfactory as that of a year ago. The balance to profit and loss account is £1,563, £310 less than last year's figure, and nearly the whole sum is required to meet sinking fund and interest charges. Two large consumers have been lost owing to them putting in their own generating plants. There was a decrease of 107,514 units sold for power and of 28,065 units for lighting. Public lighting and traction demands showed a slight increase.

Huddersfield.—E.L. PROPOSALS.—The Slaithwaite U.D.C. has asked the terms for a supply of electricity in bulk; a sub-committee has been appointed to report on the matter.

India.—According to an Indian paper, owing to the delay in completing the Tata hydro-electric plant, the Lonawali dam only being unfinished, certain of the Bombay mills have taken a supply from the tramway system. It is expected that the Tata supply will be available before the end of the year.

Leigh.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £10,000, repayable within 15 years, for additional plant at the electricity works.

The Electricity Committee has fixed ·7d. per unit net as the price of electricity supplied to the Anchor Cable Co., Ltd., for power purposes, from April 1st, the minimum supply to be 250,000 units per annum.

Leek.—The U.D.C. Electricity Committee, on the report of the engineer, has decided to have the gas engines at the electricity works overhauled by the makers and put in an efficient state.

Lindley.—STREET LIGHTING.—Owing to the failure of negotiations with the Longwood Gas Co., the Huddersfield Corporation has decided to light by electricity those roads which had hitherto been lit by the Gas Co.; the current will be transmitted by overhead cable. The change is said to be welcomed locally because the gas lamps were often blown out.

Llanfairfechan.—E.L. SCHEME.—The U.D.C. has decided to obtain by the middle of September next tenders for the necessary plant for generating and distributing electricity, using oil or steam plant; or for the supply of plant to take power from the North Wales Traction and Power Co.

London.—MARYLEBONE.—YEAR'S WORKING.—From time to time during the past year we have dealt with the progress of this undertaking. The annual accounts for 1913-14, which summarise the results, show that 17,038,516 units were sold, the total revenue amounting to £218,592, and the gross balance to £120,217; after meeting interest and loan charges, a net surplus of £4,524 remained. The total generating plant capacity increased from 12,000 to 19,000 KW., and the maximum load was 10,497 KW.; the number of consumers reached 9,755. The total connections to the mains increased by 2,759 KW. to 28,315 KW., which figure includes—lighting, 15,492 KW.; motors, 3,694 KW.; heating, cooking and "other uses," 8,656 KW.; and public lamps, 473 KW. The heating, cooking and sundry apparatus is classified as follows: —Radiators, 2,903 of 3,946 KW.; cooking apparatus, 769 of 3,001 KW.; irons, 706 of 238 KW.: medical, 594 of 481 KW.; and sundry, 1,041 of 989 KW. The motors numbered 1,322 of 4,852 H.P. It will be seen that the heating and cooking connections are increasing at a great rate, some 4,700 KW. having been added in two years. Particulars of the new turbine and three-phase plant installed during the year have appeared in our pages. We gather that the turbine units were bought as 3,000-KW. sets to run on 13¼ lb. of steam per unit, but that in reality, these machines are running with loads of 4,700 to 4,800 KW. on steam consumptions as low as 11·8 lb. per unit generated.

HAMPSTEAD.—YEAR'S WORKING.—The accounts for the year ended March 31st last, of the electricity undertaking, show a total income of £72,103, and a gross surplus of £36,819, or 8 per cent. on the capital outlay. The net surplus was £6,258, of which £1,406 was applied to reduction of capital, £1,574 to reserve, £2,162 to rate relief, and a balance amounting to £3,872 was carried forward. The units sold amounted to 5,872,308, as compared with 5,320,761 in the previous year. The generating plant capacity was 5,884 KW., and the maximum load 3,673 KW.

B.C. BULK SUPPLY SCHEME.—The Metropolitan B.C.'s Standing Joint Committee is appointing a special Committee to consider the question of taking immediate steps to provide a joint supply of electricity for the London area. The local authorities are apparently tired of waiting for the L.C.C. bulk supply scheme to materialise.

WESTMINSTER.—The Works Committee recommends that the offer of the Charing Cross Co. to replace existing arc lamps in a part of the area by Johnson & Phillips flame arcs be accepted, the Council to contribute a quarter of the cost.

Loughborough.—YEAR'S WORKING.—The returns for 1913-14 of the electricity undertaking shows that 779,600 units were sold, or rather less than in the previous year, the decrease being due to a falling off in the power demand. The B.H.P. of motors connected, however, rose from 664 to 881. The total revenue was £6,017, as against £5,563; the gross surplus was also higher, amounting to £2,759, and after meeting financial charges, &c., a balance of £392 was transferred to renewals.

Melksham.—STREET LIGHTING.—The U.D.C. has consented to the Electric Light Supply Co. giving a demonstration of street lighting by electricity free of charge, with an intimation that electricity would only be adopted on condition that the cost would be no more than for gas.

Mexborough.—YEAR'S WORKING.—The annual accounts of the electricity undertaking show a gross revenue of £5,766, and expenditure of £3,141, leaving £2,624 gross profit. On the whole year the net balance was £1,043, of which £600 was handed to relief of rates, and £443 placed to reserve. The total number of units generated was 635,782, of which 565,254 units were sold.

Monmouth.—LOAN PERIODS.—The T.C. has decided to apply to the L.G.B. for a longer period than 10 years for the repayment of the £1,600 loan required for the renewal and extension of the Corporation's electricity mains.

Normanton (Yorks).—The U.D.C. has instructed Mr. E. M. Lacey to report on the proposed electricity scheme.

Norwood Green.—PROPOSED E.L.—The R.D.C. is to obtain particulars of the cost of the electric lighting of Norwood Green and Coley in connection with a scheme proposed by the Yorks Power Co.

Plympton St. Maurice.—STREET LIGHTING.—The P.C. has received tenders for public lighting from both the Electric Lighting Co. and the Gas Co., and has decided in favour of electric lighting, at a cost of £1 17s. 6d. per 75 C.P. lamp per annum, the tender being submitted by Messrs. Heath & Co., of Plymouth.

Scremerston.—At a pit of the old colliery at Scremerston, near Berwick-on-Tweed, which is to be re-opened, electric plant for pumping is being installed.

Skelton and Brotton.—E.L. SCHEME.—The tender of Graham Bros., Middlesbrough, at £6,171, has been accepted for the installation of electricity for public and private lighting in the district; the street lighting is to be converted from gas to electric lighting.

Southampton.—NEW PLANT.—The Electricity Committee has adopted a report recommending the construction of concrete coal bunkers at the electricity works at an estimated cost of £370, and for the supply of the conveyors at £1,330. Sanction has been received to the borrowing of £4,383 for a turbo-alternator and condenser, and £3,178 for a boiler and converter. The L.G.B. has deducted £1,263 of the Council's application in respect of the outstanding debt on a 250-KW. set.

South Wales.—TURBINE EXPLOSION.—Considerable damage, estimated at £4,000, was done by the bursting of a turbo-generator at the Powell Duffryn Co.'s Penalltau Colliery, on Wednesday last week. Fortunately no personal injuries were sustained, and a duplicate plant enabled work to be resumed in a short time.

Stalybridge.—YEAR'S WORKING.—The annual returns of the Joint Board's electrical undertaking show a profit on the year's working of £8,257, as compared with £911 in the previous year. The total units generated amounted to 24,598,200, an increase of, roughly, 4,000,000 on the previous year. Of this quantity no less than 18½ million units were supplied for power purposes, traction and lighting taking 1,833,166 and 827,318 units respectively. The total revenue amounted to £62,413; working expenses amounted to £27,175, and expenditure on motors and meters, to £8,909, leaving a balance to net revenue of £26,328. After meeting interest and sinking fund charges, &c., the surplus remaining was £8,257, which was utilised in the purchase of a 3,000-KW. turbine set. It will be noted that the profit has been earned on the sale of cheap units; the average revenue obtained was only ·609d. per unit for all purposes, and the works, distribution and management cost only amounted to ·308d. per unit, coal figuring at ·18d. per unit.

St. Mellons.—PROV. ORDER.—The South Wales Electrical Power Co. has informed the Council that it intends applying for a prov. order for E.L. in this district.

Taunton.—YEAR'S WORKING.—The statement of the electricity undertaking shows a gross profit of £5,183, and after meeting interest, sinking fund, &c., transferring to renewals £304, to capital £140, a balance of £173 was carried forward.

Teignmouth.—The U.D.C. has decided to enter into an agreement with Messrs. Purves, for a refuse destructor in connection with the new electric light scheme for the town.

Wadebridge.—STREET LIGHTING.—At the monthly meeting of the U.D.C. tenders were received from the Gas Co. and the Electric Light Co. for the town lighting, and it was resolved to accept the Electric Light Co.'s tender for electric lighting for seven years, at £1 8s. per lamp per annum for 88 lamps.

Walsall.—NEW GENERATING STATION.—The Electricity Committee has entered into an agreement with the Birmingham Canal Navigations in regard to canal water for the proposed new generating station; the Committee has also arranged for a new wharf at the station at an estimated cost of £500.

A railway siding is under consideration and a plan and estimate for a double line at a total cost of £1,020 has been submitted. The sanction of the B. of T. has been received to the erection of the new works on the site proposed by the T.C.

Wells.—PROV. ORDER.—Messrs. Christy Bros., Ltd., of Chelmsford, have informed the T.C. of their intention to apply for a prov. order to supply electricity in the district.

West Ham.—There was a surplus on the working of the electricity undertaking for the year ended March 31st last of £751. The total working expenses amounted to £91,026, as against £71,611 last year, an increase of £19,414. The total income was £133,505, as compared with £110,154, an increase of £23,350; the gross profit was £42,479, against £38,542 in the previous year. The total units generated were 40,969,428, of which 34,404,791 were sold. The total maximum supply demanded during the year amounted to 12,225 KW.

The Electric Lighting Committee recommends the purchase of an electric vehicle from the Edison Co., at a cost of about £700.

Wimbledon.—YEAR'S WORKING.—During the past year the output of the Council's electrical undertaking reached 3,786,000 units. The maximum load was 2,197 KW. and the connected load nearly 9,000-KW. The total revenue was £37,417, and after meeting working and financial charges, the net surplus was £3,471. This was transferred to a suspense account, which now amounts to £10,262. The reserve fund also has £14,296 to its credit, and the undertaking appears to be generally flourishing.

Wolverhampton.—YEAR'S WORKING.—The result of the working of the electricity undertaking for the year 1913-14 was a net profit of £8 677—the highest yet made. This was allocated, £6,552 to reserve, and £2,125 to the rates; the reserve fund stands at £19,161. The units sold were over 13 millions, an increase of 720,000. The motors connected represent 8,764 H.P. The destructor works supplied 1,472,530 units, for which £1,227 was paid. The Committee points out that it will be necessary to draw on the reserve fund shortly for capital purposes.

TRAMWAY and RAILWAY NOTES.

Bradford. — RAILLESS TRACTION. — Certain of the authorised railless trolley vehicle routes are now approaching completion, and the Tramways Committee has decided to recommend that application be made in each case for early inspection by the B. of T.; that each route be opened as soon as the formal sanction has been received and that the fares on each route be 1d. for the through journey, and ½d. between the centre of the route and either terminus.

Chile.—The Commission appointed to report on the proposed railway from Santiago to Valparaiso *via* Casa Blanca, has advised the construction of an electric railway of the same gauge as the State line now connecting the capital with Valparaiso. The Commission further proposes the construction of branch lines to Melipilla and Talagante, thus linking the line with the Central and Southern State systems. It is suggested that the former proposals for the electrification of the present steam railway system should be abandoned for the time, and the £2,300,000 intended for this undertaking could then be utilised in the construction of the proposed new line.

Continental Notes.—GERMANY.—The concession for the Schöneiche to Kalkberg electric tramway, Berlin, has been sanctioned, the period up to 1940 being covered. The line must be completed within two years under a penalty of £250.

HOLLAND.—A strike has occurred on the Hague tramways, and strike breakers have been imported from Berlin, a partial service being maintained.

Croydon.—ANNUAL REPORT.—In his annual report, Mr. T. B. Goodyer, general manager of the Corporation tramways department, states that the total receipts for the year ended March 31st last were £87,026, and the working expenses £69,744. The net balance was £1,362, from which £1,132 was taken to cover the alterations at the chief depôt, and £230 was carried to the renewals fund, as compared with £7,586 for 1912-13. Compared with the previous year the traffic receipts decreased by £5,617, the car-mileage increased by 150,371, and the passengers carried decreased by 1,276,265. Working expenses went up by £3,525. The decreased net balance—from £10,586 to £1,361—was very largely attributed to motor-'bus competition, coupled with unfavourable weather, and by reason of the extra mileage run to meet competition. The total receipts per car-mile decreased by ·92d. The passengers carried totalled 19,227,878.

Dartford.—Messrs. Balfour, Beatty & Co., Ltd., have applied to the B. of T. for an extension of time until August 18th, 1916, for the completion of the tramways authorised by the Dartford and District Order of 1911.

Denton (Lancs.).—A meeting of the various local authorities interested was recently held to consider the steps to be taken for acquiring the undertaking of the Oldham, Ashton, and Hyde Tramways Co., which traverses the district. Two miles of route are situated in Ashton, and a special meeting of the Ashton T.C. is to consider the future of this section.

East Ham.—The West Ham Union has decided not to object to the assessment of the tramways being reduced; the proposed reduction on rateable value is £1,950, to £4,700. This figure, however, the Finance Committee considers should be still further reduced.

Horbury.—'BUS SCHEMES. — The Yorkshire (Heavy Woollen District) Electric Tramways Co. contemplates the establishment of a service of motor-'buses between Dewsbury and Wakefield, through Horbury, and has applied for sanction. The National Electric Construction Co., which already runs motor-'buses in other parts of this neighbourhood, attempted to establish such a service between Ossett and Wakefield, but it did not meet with success.

Huddersfield.—The financial statement of the tramways for the three months ended June 30th last shows a net surplus of £7,197, or 2·59d. per car-mile, compared with £4,309, and 1·70d. last year. The tramway manager is to report on the following suggested tramway extensions:—From Outlane to Stainland; from Ashbrow Road to Bailiff Bridge; and from Huddersfield to Brighouse *viâ* Rastrick.

Mexborough.—The Mexborough and Swinton Tramways Co. has purchased a site at Mexboro' Toll Bar, for a car-shed to accommodate the railless trolley cars for the new service.

Radcliffe.—The D.C. has declined to revise the price charged for electricity in connection with the Bury tram service.

Stalybridge.—YEAR'S WORKING.—The returns of the Joint Board's tramway undertaking, show a deficit on the year's working of £5,870, which, however, was less than in 1912-13, when the loss was £9,124. Nearly 10 million passengers were carried, the revenue amounting to 8·4d. per car-mile, as against 7·8d. in the previous year.

South Africa.—The East London (Cape Province) Municipality proposes to borrow a sum of over £12,000, of which amount £7,814 is to be utilised for the extension of the tramway system, covering duplication of the existing track and rearrangement of the overhead equipment, and £775 for electric supply extensions.

Southampton. — After considering a report by the tramway manager, the Committee recommends the purchase of three 'buses, at a cost of about £2,600. Repair work to 21 tramway cars in the near future will cost about £3,500, to be spread over three years. The borough electrical engineer is to obtain two motor vehicle chassis and to fit one up for battery traction.

Stretford. — After lengthy negotiations, the Trafford Park Estates, Ltd., has now liquidated the outstanding district rates in respect of the tramways and light railways situated in the Stretford portion of Trafford Park, on the basis laid down in the Tottenham case, which included payment in full in respect of non-statutory railways.

West Ham.—YEAR'S WORKING.—The working of the tramways last year resulted in a deficit of £14,421; it is proposed to meet this by levying a 2d. rate and by contributions from reserve.

West Hartlepool.—An order has been made by the Light Railway Commissioners, modified and confirmed by the B. of T., authorising the Corporation to borrow money for the light railway authorised by the West Hartlepool Light Railways Order, 1897, and by the West Hartlepool Light Railways Deviation Order, 1901, and for other purposes.

TELEGRAPH and TELEPHONE NOTES.

Automatic Telephones.—Replying to a question in Parliament as to the result of the experimental employment of the automatic telephone system at Epsom, the Postmaster-General stated that it had proved "fairly successful." This is a remarkable statement, especially as Mr. Hobhouse went on to say that it was clear that the automatic system was applicable to large areas, and arrangements had been made (as stated in this column some months ago) to install automatic exchanges in nine provincial towns, including Leeds. We are under the impression that the exchange at Epsom, so faintly praised by the P.M.G., has in fact been found entirely satisfactory in all respects, and this is confirmed by the decision to go ahead with the other automatic exchanges—for who, in his senses, would install costly apparatus that was only "fairly successful," for public service in large towns like Leeds and Portsmouth?

Fire Alarms.—As the result of a visit to America by two officials, the Fire Brigade Committee of the L.C.C. is considering the installation of a new system of fire alarms in London, subject to the completion of certain experimental work.

Greece.—A wireless telegraph station has recently been completed at Syra, in the Cyclades group of islands, by the Greek Government, and is now open to the public, principally for messages to Samos.

International Commission for Radio-telegraphic Research.—The Commission held a sitting on April 6th, 1914, at Brussels, under the presidency of Mr. Duddell (London), at which the Commission was definitely constituted; the results already obtained were discussed, and arrangements were made with regard to future experiments. National Committees have been constituted in Belgium, France and Great Britain. In Germany, many stations have agreed to receive the signals, and a more complete organisation will be formed very soon. National Committees are also in course of formation in Austria, Russia, Italy, Switzerland, &c. At the last meeting the Statutes of the International Commission were drafted in a definite form and adopted.

It was decided to co-operate as far as possible with the Committee for Radiotelegraphic Investigation of the British Association for the Advancement of Science.

A demonstration of the methods of emission and measurement in use at the high-power station at Laeken-Brussels took place before the Commission, and reports were read by Messrs. R. Goldschmidt and R. Braillard, on the changes that had been made and on future alterations. Mr. Lutze read a report on the measurements he had taken at the transmitting station as well as those made at the control station, and several of the delegates reported the results of the reception of the signals which were sent according to the programme agreed upon at the preliminary meeting in October, 1913.

The reports led to a general discussion on the strength of the signals received at the various receiving stations, and the Commission expressed the wish that the experimenters should send in with the results of their experiments the characteristics of their antennæ, and that whenever possible they should employ photographic registration.

A paper was read by Mr. Duddell with regard to the methods and instruments to be employed at the different stations. One of the propositions was to employ a closed circuit to receive the signals at the control station, similar to that used by Mr. Braun (Strassburg). Communications were also read by other members.

A general programme of future work was proposed by Mr. R. Goldschmidt, and was adopted after discussion with slight modification.

Dr. Eccles read a report on the steps that had already been taken in connection with the B.A. Committee, in view of the solar eclipse of August 21st. It was decided to nominate a special committee

to consider the matter, consisting of Messrs. Benndorf, Eccles, Ferrié and Wien.

The statutes in their amended form were ratified, and the financial statement of the Commission was discussed and approved.

The officers of the Commission, provisionally elected at the first meeting, were confirmed as follows:—Mr. Duddell, President; Mr. Wien, Vice-President; Mr. Goldschmidt, General Secretary; Mr. R. Braillard, Assistant Secretary.

Italy.—A wireless station has been set up at Tarento, chiefly for the use of the Italian fleet. The range of the station is 2,000 km., so that the whole of the northern coast of Africa, the western coast of Europe as far as the Canary Islands, the northern and southern coasts of England, and eastward as far as Russian Poland are embraced.

Manchester.—Good progress is being made with the improvement of telephone facilities in the Manchester district. During the six months ending April 30th, 39 miles of underground ducts and 26 miles of cable have been laid for local service, and the number of telephones in use has increased from 34,904 to 36,087.

Norway.—The report for 1913 of the Spitzbergen Wireless Telegraph Station has been published, and shows that the number of inland telegrams forwarded to Norway amounted to 489; to other countries were sent 353 messages, in addition to 267 messages for which no fees were paid. The number of paid telegrams received was 261 from Norway and 130 from abroad, besides 309 unpaid messages. The total number, with 37 service messages and 365 meteorological reports, was 2,208 in all. The Spitzbergen station is the most northern in the world, and although the number of messages is not very imposing, it is, nevertheless, a very important station, especially on account of its meteorological reports, which are exceedingly valuable to science from that high latitude.

Telephone Poles.—The P.M.G. has issued an appeal to British timber growers to meet the heavy demand of the Post Office for poles in connection with the development of the telephone system. He recently had to place contracts for over 100,000 poles, in addition to the normal supply, for which 65,000 poles a year are required. He desires to use British timber, but hitherto hardly any suitable poles have been obtainable from home sources. Scotch pine and larch are the most suitable trees, and are easily grown here. Full particulars of the Department's requirements can be obtained from the Controller of the Post Office Stores Department, 17-19, Bedford Street, Strand, W.C.

The Imperial Wireless Chain.—The Indian station will be situated at Kirkee, near Poona, 120 miles inland from Bombay. The *Daily Telegraph* reports that two Marconi engineers have arrived on the spot, and that the work of construction will take two years.

The Telephone Service.—Referring to the Postmaster-General's statement in Parliament last week that inquiries had been made of 135,000 telephone subscribers in London, and 128,000 replied, 87 per cent. of whom reported that the service was perfectly satisfactory, Mr. C. S. Goldman, chairman of the Parliamentary Telephone Committee, has written to the Press pointing out that the inquiries were purely verbal, and were limited to the question: "Is your line working all right"? He himself had answered the question in the affirmative, not knowing that it represented a formal inquiry as to the efficiency of the service as a whole. On the other hand, his Committee had circulated forms containing 24 questions to 2,500 of the largest telephone users in London, and of the 1,000 replies already received, not ten expressed satisfaction with the service. The whole profit on the telephone system, he says, is now less than the royalty paid by the National Telephone Co. to the State before declaring their dividend of 6 per cent.

The Finance and General Purposes Committee of the Bradford Corporation last week decided to summon a conference of Corporation representatives on Telephone Advisory Committees in Leeds, Halifax, Sheffield, Huddersfield and Bradford, to consider a scheme under which those municipalities should take over complete control of the telephone services in their areas.

The Telephote.—A recent communication to the French Academy of Sciences by Mr. Georges Rignoux describes apparatus which he has developed for transmitting pictures with two wires only. The device employs selenium cells, and the inventor has so far succeeded in reproducing letters of the alphabet.

Wireless on Board Ship.—On Tuesday a Committee of the House of Commons commenced the consideration of the Merchant Shipping (Convention) Bill, which gives effect to the recommendations of the International Conference for the Safety of Life at Sea.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—August 4th. U.D.C. One natural-draught chimney-type cooling tower. See "Official Notices" July 10th.

Ashton-under-Lyne.—Corporation. July 29th. Arc lamp globes, lamp carbons, D.C. motors and D.C. motor starters. See "Official Notices" July 10th.

Australia.—SYDNEY.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

PERTH.—August 19th. Electric lamps and fittings, for P.M.G. See "Official Notices" to-day.

August 19th. Telephone switchboards, galvanised iron and steel stranded wire, for Postmaster-General. See "Official Notices" to-day.

September 2nd. Telephone instruments and parts, glassware, battery material, chemicals for batteries, wire—cotton, silk or wool covered—telegraph and telephone insulators, for Postmaster-General. See "Official Notices" to-day.

MELBOURNE.—October 7th. Victorian Railway Commissioners. Four motor-driven air compressors and electrical equipment (motors, &c.) for the new workshops at Ballarat and Bendigo. Specification may be seen at the Board of Trade Commercial Intelligence Department in London.

July 29th. (Contract No. 49) Wheels and axles; (50) maximum traction trucks; (51) single-type trucks; (55) motor equipments and magnetic brakes for maximum traction trucks; (56) motor equipments and magnetic brakes for single-type trucks. For the Prahran and Malvern Tramways Trust. Specifications (£2 2s.) from the Secretary, 59, William Street.

RICHMOND.—Nov. 30th. Refuse destructor and auxiliary plant. Specification, &c., from Mr. C. C. Blazey, Town Clerk, Richmond, Victoria.

BRISBANE.—September 2nd. Switchboards, parts and accessories, for the P.M.G. See "Official Notices" to-day.

ADELAIDE.—September 2nd. Telephone material, bells, &c., condensers, diaphragms, generators, for the Postmaster-General. See "Official Notices" to-day.

Blackburn.—August 1st. Twelve months' supply of steam coal for the Electricity Department. Mr. P. P. Wheelwright, Engineer and Manager.

Bolton.—July 19th. Corporation. Converting plant, sub-station E.H.T. and H.T. switchgear. See "Official Notices" June 12th.

Bradford.—The Corporation Technical Education Sub-Committee is inviting tenders for motors to drive the workshop and mechanics' and testing laboratories; also for a surface condenser suitable for the heat engine laboratory, and for apparatus required for heat treatment of steel.

Chichester.—July 18th. Refrigerating and electrical plant and wiring, for Chichester and District Co-operative Bacon Factory. Messrs. Horace Boot & Partners, 7, Victoria Street, S.W., consulting engineers.

Dartford (Kent).—July 20th. Telephones, extension bells, &c., at Joyce Green Hospital, for Metropolitan Asylums Board. See "Official Notices" July 10th.

Dewsbury.—July 18th. Steam coal for the electricity works, Bradford Road. Mr. R. H. Campion, Borough Electrical Engineer.

Eastbourne.—August 18th. Corporation. Main machine and feeder switchboard for the electricity works. See "Official Notices" to-day.

Edinburgh.—July 20th. Corporation Electricity Supply Department. Extension of steam and exhaust pipe work at McDonald Road station. Town Clerk, City Chambers.

Greenock.—July 23rd. School Board. Electrical installation at the Greenock Academy. Specification from Mr. A. F. Neven, Clerk, Municipal Buildings, Wallace Square.

July 27th. 20,000 tons of steam coal (washed singles and pearls) for the Corporation electricity works. Mr. J. H. Parker, Engineer.

Grimsby.—July 23rd. Corporation. 790 ampere-hour battery, reversible booster and switchgear. See "Official Notices" to-day.

Kingston-upon-Hull.—August 22nd. Corporation. Electrical fittings for the Guildhall Council Chamber, &c. See "Official Notices" to-day.

London.—L.C.C. July 30th. 10,000 or 5,000 driving and pony wheel tramcar tires, 300 axle forgings for tramcars. Chief Officer, Tramways Department, 62, Finsbury Pavement, E.C.

Manchester.—July 21st. Corporation. Two steam boilers, for the Tramways Department. Specifications from Mr. J. McElroy, General Manager, 55, Piccadilly.

July 24th. Corporation sub-station. 6,600-volt switchgear (one year's requirements); fuse boxes (two years' requirements). See "Official Notices" July 10th.

New Zealand.—NEW PLYMOUTH.—August 28th. 6,600 volt sub-station switchboard, additions to 2,300-volt sub-station switchboard, for the New Plymouth B.C. Specifications may be seen at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

Salford. — Flame arc lamps and lowering gear, for electricity works. See "Official Notices" to-day.

Southampton.—August 6th. Installation of lighting plant, cables, &c., at the Farm Institute, Sparsholt. See "Official Notices" to-day.

Stockton-on-Tees.—July 24th. Corporation. Coal for use with mechanical stokers, for the Electricity Department. Forms of tender from Mr. J. J. Smith, Borough Electrical Engineer.

Tavistock.—Public lighting for one, three or five years, for the U.D.C. Mr. E. Warran, Clerk.

Torquay.—July 20th. Corporation. 5,000 tons of coal for use with mechanical stokers, for the Electric Lighting Committee. Specification from Mr. F. S. Hex, Town Clerk.

Turton.—July 23rd. U.D.C. Overhead lines and underground cables. See "Official Notices" July 10th.

Walsall.—August 11th. Corporation. Coal conveyor and measuring apparatus, jib coaling crane, ash-handling plant, travelling crane. See "Official Notices" to-day.

Warrington. — July 21st. Extra-high-tension switchboard feeder panel and low-tension switchboard feeder panel, for Borough Electricity Dept. See "Official Notices" July 10th.

West Ham.—July 20th. Lighting installation at Rosetta Road School, for Education Committee. See "Official Notices" June 26th.

Worthing.—July 20th. Corporation. Twelve months' supply of Welsh and other steam coal for the electricity works, &c. Particulars from Mr. J. K. Allerton, Town Clerk.

York.—July 20th. Twelve months' supply of coal to the electricity generating station, Foss Islands Road. Mr. J. W. Hame, Engineer and Manager

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CLOSED.

Ashton-under-Lyne.—The tenders of the New Moss Colliery Co., Ltd., and Mr. H. Johnson, for six months' supplies of coal for the Electricity Committee have been accepted.

Atherton. — The U.D.C. has accepted the following tenders :—

Callender's Cable & Construction Co., Ltd.—2,800 yards of cable, with conduits.
General Electric Co., Ltd.—Switchgear.
G. Hanchett Barratt & Co., Ltd.—Transformers.

Australia.—The following contracts have been placed :—

P.M.G.'s Department, Victoria :—
Portable engine and dynamo, £330.—Russell & Co.
16 cable jointer's trucks, £88, 20 linemen's trucks, £240.—Coffey Bros.
P.M.G.'s Department, South Australia :—
6,000 insulators, porcelain, pattern "A," 6¾d. each.—Warburton, Franki (Melbourne), Ltd.
4,350 protectors for use at subscribers' telephone stations, 3s. 4d. each.—British General Electric Co., Ltd.
P.M.G.'s Department, Tasmania :—
18,000 insulators, porcelain, pattern "A," 6¾d. each.—Warburton, Franki (Melbourne), Ltd.
8,000 insulators, porcelain, pattern "A," brown, 7¾d. each.—Warburton, Franki (Melbourne), Ltd.
Royal Naval College, Jervis Bay :—
Material and plant for the installation of electrically-driven pumping set, £475 12s. 6d.—Haes & Eggers, Ltd.
Electric wiring of buildings, £1,488.—Handley & Lewis.
Victorian Railway Department :—
Sulphate of copper (best quality) for battery maintenance, at £24 8s. per ton.—S. Cohen, Sons & Co. Ppty., Ltd.
One 15-ton electric crane for Ballarat, £2,005.—Babcock & Wilcox, Ltd.
Sydney Municipal Council :—
Bare copper cable, £2,190.—Standard Cable Manufacturing Co.
Insulated cable, £212.—B.I. & H. Cables.
Underground feeders (11,000-volt cable), £10,119.—Western Electric Co.

—*Australian Mining Standard.*

Bradford.—The Corporation Electricity Committee has accepted the tender of Messrs. Ferranti, Ltd., for two 250-K.V.A. transformers, at £131 each, and four 150-K.V.A. transformers, at £102 each.

Bristol.—The Bristol Tramways and Carriage Co., Ltd., has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for carbon-filament lamps.

Gravesend.—The tender of the Western Electric Co. has been accepted, at £1,044, for the supply and laying of H.T. cables.

Horsham. — The U.D.C. has accepted the tender of Messrs. Bradbury, Son & Co., for 700 tons of coal for the electricity works, with the option of small Glyncorrwg, at £1 0s. 2d. per ton, and small Newbury, at 16s.

London.—L.C.C.—The Fire Brigade Committee recommends "That owing to the failure of the 'Cedes' Electric Traction Co., Ltd., to complete and deliver, under the terms of the contract, by June 14th, the petrol-electric chassis for an escape van, the contract with the company be determined, and that the offer of Leyland Motors, Ltd., for the supply of a motor escape van, similar to 11 now on order, for £641, be accepted."

The Highways Committee reports having accepted the tender of Messrs. Steel Peech & Tozer, Ltd., for the supply of 250 steel axle forgings, and 50 steel axle forgings, at 48s. and 36s. 3d. each forging respectively, also the tender of Messrs. S. Bowley & Sons, for the supply of finishing insulating varnish for the Council's tramways.

METROPOLITAN ASYLUMS BOARD.—For the purchase of abandoned electrical plant at the Brook and Park Hospitals the following tenders were received :—

J. Levy & Sons	(accepted)	£675
A. Learoyd		503
J. T. Learoyd & Sons		442
J. Hyams		421
A. Brown & Sons		389

(The Engineer-in-Chief's estimate was £1,000.)

EALING.—The T.C. has placed contracts for supplies for the year with the following :—

Pipes, bends, &c.—Sankey & Co. and Wiggins & Co., alternate months.
Cylinder oil, crank-chamber oil, and bearing oil.—Stern Sonneborne Oil Co.
Paraffin oil.—Bruce Wallace & Co.
Coal.—E. Foster & Co.

HACKNEY.—The Electricity Committee reports that, in consequence of the strike in the building trade, the erection of the electricity sub-stations has been considerably delayed, and in order to expedite the work and enable the sub-stations to be finished in time for the next winter's load, the contractors desire to sub-let a portion of the work. The Committee recommends the Council to agree to the request.

SOUTHWARK.—The tender of the General Electric Co., Ltd., is recommended for acceptance to supply 14 Angold magazine flame lamps during the ensuing 12 months.

Skelton and Brotton (Yorks.). — The U.D.C. has accepted the tender of Messrs. Graham Bros., of Middlesbrough, for the complete works included in the specification of Messrs. May & Hawes, the Consulting Electrical Engineers to the Council, for overhead lines, underground cables, transformers, switchgear, and public lighting fittings, amounting to £6,170.

Southampton.—The tenders accepted by the Electricity Committee for supplies of coal are as follows :—

Bradbury, Son & Co., Ltd.—3,500 tons Tamworth beans, 15s. 10d. per ton.
Southampton Steamship Coal and Patent Fuel Co.—500 tons Denaby washed peas, 16s. per ton.
Cory Bros. & Co., Ltd.—3,500 tons Scotch washed pearls, 15s. 7½d. per ton.
Rea Transport Co., Ltd.—1,000 tons Scotch single nuts, 14s. 10d. per ton.
Albert Usher & Co.—7,000 tons Tamworth beans, Measham beans, and Newdigate peas (seller's option), 15s. 6d. per ton.

The following tenders have been received by the Town Council for 200 tons of tramway rails :—

Lorain Steel Co., £7 per ton.
Walter Scott, Ltd., £7 per ton.
North-Eastern Steel Co., £6 18s. per ton (accepted).
Frank Mott, £6 14s. 8d. per ton (three months' delivery).
Dick, Kerr & Co., £6 12s. per ton (German rail).
Barrow Hematite Steel Co., £6 10s. per ton (informal).

Swansea.—The T.C. has accepted the tender of the Main Colliery Co. for a year's supply of coal to the electricity station.

Winchester.—The T.C. has accepted the tenders of Mr. R. G. Gifford and Messrs. Bradbury, Son & Co., for the supply of coal to the Electricity Works, the former about 1,250 tons of Writhlington coal, and the latter about 750 tons of Camerton coal. The prices were appreciably lower than the previous contracts.

Wolverhampton. — The Corporation Electricity Committee has accepted the following tenders :—

G. & J. Weir, Ltd.—Turbine-driven pump, £235.
J. Spencer, Ltd.—Steam and feed-water piping, £234.
Dorman & Smith.—Alterations to generating-station switchboard, £68.

The offer of Messrs. Mossay & Co., Ltd., is recommended for acceptance for the supply of a Lloyd electric 2½-ton chassis on hire for three months, at £42.

Worksop. — The U.D.C. has accepted the tender of Messrs. Glover & Co. for cable, at £82.

FORTHCOMING EVENTS.

Tramways and Light Railways Congress.—Friday, July 17th. At Newcastle-on-Tyne. Second and concluding day of proceedings. For papers to be read see page 1095 of our issue of June 26th.

Junior Institution of Engineers.—Saturday, July 18th. At 2.30 p.m. At Purfleet. Visit Tunnel, Portland Cement Works.

Monday, July 20th. At 7.45 p.m. At 26, Corporation Street, Manchester. Meeting of North-Western Section. Paper on "Gassing," by Mr. E. Eaves.

Nottingham Society of Engineers.—Saturday, July 18th. Ladies' day: Visit Sherwood Forest.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION.)

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued :—

Headquarters will be opened daily for the transaction of regimental business from 10 a.m. till 4 p.m., except Saturdays, on which days the opening will be from 10 a.m. till 12 noon. Headquarters will be closed for all purposes on August 3rd and 4th, 1914.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

NOTES.

Electrical Contractors Combining.—At a meeting of the Blackburn Chamber of Trade, on Monday last, a letter was read in which it was stated that the electrical contractors of the town proposed forming a protective association, and an inquiry was made as to whether the Chamber were prepared to accept them as a separate section. A resolution was carried accepting the new association and expressing the hope that it would be very successful.

The Goods Clearing-House System.—Mr. A. W. Gattie has received a letter from Mr. H. C. Long, of Boston, who has been sent as a Commissioner on Transportation to this country, in search of means to solve the terminal problem in Boston, where the question has become acute. Mr. Long is satisfied that Mr. Gattie's system can be used, although with less advantage than in London, and regards the adoption of some such central sorting station as inevitable, because it is an absolute economic necessity.

Tyneside Scientists Honoured.—Sir Charles A. Parsons, K.C.B., F.R.S., the inventor of the steam turbine, was honoured at Newcastle-on-Tyne on the 10th inst., when the honorary freedom of the city was conferred on him in recognition of his distinguished services in the cause of science, particularly in the invention and development of steam turbine engines. There was a distinguished company at the ceremony, over which the Lord Mayor (Mr. Johnston Wallace) presided. The scroll was contained in a silver-gilt casket.

In making the presentation, the Lord Mayor said that in Sir Charles Parsons they had an example of hereditary genius, encouraged and developed by wisely-planned vocational teaching. In 1884 he patented the steam turbine. The first one was about 10 H.P., and ran at the astounding rate of 18,000 R.P.M. At that time there was a need for a high-speed engine for driving electrical machinery. The invention of the turbine necessitated also the invention of a high-speed dynamo to be driven by it. In those early days—30 years ago—little was known of the theory of the dynamo ; in fact, it was not until two years afterwards that the late Prof. John Hopkinson put the theory on a firm footing, and the invention at that date of a high-speed dynamo running at 18,000 R.P.M. was a great achievement. It was safe to say that without Sir Charles Parsons's invention they would not have had the great development of electrical power, and at the present time there was not a single reciprocating steam engine of large size being put into any power station in the world. The Lord Mayor also referred to marine turbines, and to the marvellous manner in which they had superseded reciprocating engines.

Sir Charles Parsons, in reply, expressed his appreciation of the honour conferred upon him. He said that when he commenced to work on the steam turbine with a hope of making it a practical success it seemed to him that, in spite of the fact that many had failed in their endeavours, yet it was right in principle, and that after a thorough experimental investigation it should be possible to realise success. In short, he thought it was worth trying ; encouraging results followed, one improvement led to another, and it gradually became an efficient motor. When it had beaten the compound engine at driving a dynamo, his old friend, Dr. J. B. Simpson, said why not try it at driving a ship, and he replied that he thought that the time was ripe for an attempt. That was the beginning of the marine turbine and of a strenuous time. Sir Charles closed with an appreciative reference to many valued friends who had helped him in his efforts.

It had been the intention of the Newcastle-on-Tyne Council to confer a like honour on Sir Joseph W. Swan, the inventor of the incandescent electric lamp, but although the resolution of the Council had created him an honorary freeman, he was not spared to receive the tangible indication of the honour ; the scroll containing the resolution of the Council was presented on the 10th inst. to Mr. Kenneth Swan, together with a service of silver plate.

The Lord Mayor, in handing the resolution to Mr. Swan, specially referred to Sir Joseph's work in electricity and photography.

Mr. Kenneth Swan, acknowledging the gifts, said it was there in Newcastle that his father dreamed his dreams of science, and foretold the end of the age of darkness and the coming of the era of light. His dreams had become realities, and his prophecies had been fulfilled.

Institution and Lecture Notes.—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—At the annual Convention of the Institute at Detroit last month, the President, Mr. C. O. Mailloux, said that engineers had not paid enough attention to their relations with the outside world. As a professional class they were entitled to a higher place than had been accorded them by the public. Tasks of social re-arrangement were ahead of the body politic, and they provided a field of work where the technical training of the engineer should be almost indispensable. The lawyer, the politician, the agitator and the Utopian dreamer pressed forward, while the engineers held back. The members of the Institute should show that engineers were well qualified to discuss and deal with public questions ; they must take a social plane parallel to those occupied by the older professional classes.

Mr. D. M. Mahood stated that the great new vessels, like the *Vaterland*, *Imperator*, *Aquitania*, *Oceanic* and others, had electric heating for the first and second cabins.

Mr. H. C. Ford said that the gyro-compass was now being installed on all the battleships and submarines of the United States Navy where the magnetic compass could not possibly be used. On submarines, where the gyro-compass was exceedingly important a three-phase, 90-volt generator of special design was required to drive the heavy balance wheel at a speed of about 8,600 R.P.M So exact was the gyro-compass that the maximum error must not exceed 0·5° in azimuth when swung for six days under conditions of rolling, pitching and yawing of an artificial ship. The stabilising gyro would require one-tenth the space and weight of the equivalent best designed water pendulum.

In the Industrial Motor Session, Mr. R. R. Tschentscher spoke of the extensive use of electricity in the iron and steel industry. Statistics from 170 plants showed an aggregate of 400,000 KW. in generator rating and 1,400,000 H.P. in motors now in operation in these steel mill plants. The electrical plants of steel mills were usually very large, and averaged outputs of 10,000,000 KW.-hours yearly.—*Electrical World.*

INSTITUTE OF MARINE ENGINEERS.—On July 4th the members of the Institute visited the foundries of the Manganese Bronze and Brass Co., Ltd., Millwall, where bronze propeliers for the largest ships in the world are cast, to say nothing of the many other branches of the company's business.

Educational Notes.—UNIVERSITY COLLEGE, LONDON.—In the faculty of engineering the following awards have been made :—Chadwick Medal and Prize, J. A. Parker ; Andrews Scholarship (second year), J. Mould ; Goldsmid Scholarship (second year), H. P. Gardham ; (third year), P. L. Capper ; Archibald P. Head Medal and Prize, Z. S. Quai. Diplomas in Electrical Engineering :—A. Arias, G. G. Lawson and D. G. Trouton.

NORTHAMPTON POLYTECHNIC INSTITUTE. — The Aitchison Memorial Scholarship, established by the friends and colleagues of the late Mr. James Aitchison, in consideration of the valuable services rendered by him to the optical industry, is tenable in the full-time day courses in technical optics at the Institute, and is of the total value of £30. The first will be awarded in September, 1914. Inquiries should be addressed to the Hon. Secretary, Mr. Henry F. Purser, 35, Charles Street, Hatton Garden, London, E.C.

IMPERIAL COLLEGE OF SCIENCE.—The Governors have appointed Dr. A. N. Whitehead, F.R.S., to the new chair of Applied Mathematics.

Appointments Vacant. — Assistant lecturer in the department of Electrical Engineering at Birmingham Municipal Technical School (£150) ; lecturer in electrical engineering (£180), for East London College ; test room assistant and meter mechanic for Newport Electricity and Tramways Department ; assistant mains superintendent (£150), for Derby B.C. Particulars are given in our advertisement pages.

Fatalities.—On Monday last Samuel Dorsett, 28, Wolverhampton, was killed at the works of Messrs. Jordan & Sons, Bilston, where he was employed as an electrician. He was removing a belt from a pulley connected with a dynamo to another pulley, when one hand became locked. His mate, John Butler, released him, and both received severe electric shocks. Butler recovered.

A Birmingham paper states that at Immingham Dock on Monday a labourer, John Joyce, was engaged painting a ship's bottom in the dry dock, when he came in contact with a live wire and was instantly killed. The inquest was held on Tuesday. In picking up a flexible cable Joyce broke it, according to the evidence. The jury found that he died from electric shock, but declared that there was not sufficient evidence to show how it was caused.

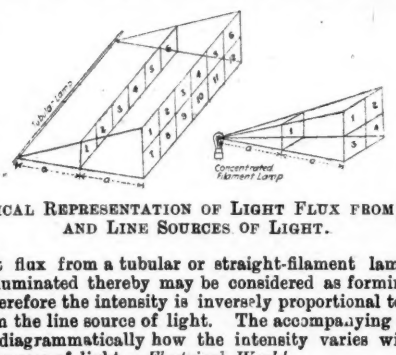
Inquiries. — A correspondent asks for the name and address of the maker of the "Hubble adjustable gallery for shades" ; another wants the addresses of suppliers of tramway tokens in celluloid or aluminium.

Parliamentary.—ROYAL ASSENT.—The following Acts have received the Royal Assent :—

Electric Lighting Orders Confirmation (No. 1) Act, 1914.
" " " " (No. 3) "
" " Order Confirmation (No. 8 Kingstown) Act, 1914.
Tramways Order Confirmation Act, 1914.
Western Valleys (Monmouthshire) Railless Electric Traction (Extension) Order Confirmation Act, 1914.
Glasgow Subway Railway Order Confirmation Act, 1914.
Colinton Tramways Extension Order Confirmation Act, 1914.
Stone Gas and Electricity Act, 1914.
London Electric Railway Act, 1914.
Central London Railway Act, 1914.

THIRD READING.—In the House of Commons on July 9th the North Metropolitan Electric Power Supply Bill was read a third time.

Tubular Light Sources.—While the familiar law of inverse squares holds for the intensity of illumination surrounding a point light source, it must be remembered that different conditions exist when the light source has considerable area or length.



GRAPHICAL REPRESENTATION OF LIGHT FLUX FROM POINT AND LINE SOURCES OF LIGHT.

The light flux from a tubular or straight-filament lamp to the surface illuminated thereby may be considered as forming a solid wedge, therefore the intensity is inversely proportional to the distance from the line source of light. The accompanying drawings illustrate diagrammatically how the intensity varies with point and line sources of light.—*Electrical World.*

Woking Technical Institute.—On Wednesday evening, the Rt. Hon. Lord Moulton, P.C., F.R.S., opened the County Secondary School for Boys and Technical Institute at Woking. The proceedings were presided over by Mr. Patrick White, chairman of the Education Committee, who made most appropriate and otherwise excellent introductory remarks in which, among other topics, he reviewed Lord Moulton's career. A full statement by Mr. T. Ivor Moore, the chairman of the Higher Education Committee, on the objects of the Institute, followed. Lord Moulton then addressed the gathering, delivering a first-rate dissertation on education generally and technical education in particular, in which he compared the advantages available to the youth of the present day with the lack of them which characterised his own (Lord Moulton's) early days. After votes of thanks and the national anthem an inspection of the building took place. The Woking Musical Society, under the conductorship of Mr. Patrick White and Mr. W. D. Boseley, Mus. Bac., rendered a full programme of music in fine style. The ELECTRICAL REVIEW desires to thank the following gentlemen and electrical firms who, in response to its invitation, so generously contributed some of the electrical machinery and apparatus which form part of the equipment of the Institute :—

A well-known firm of electrical instrument makers (anonymously).
Mr. H. Bevis (Messrs. Pirelli, Ltd., London).
Mr. Justus Eck (Union Electric Co.).
Messrs. Evershed & Vignoles, Ltd., London.
Mr. M. H. Gray (the India-Rubber and Gutta-Percha Co., Silvertown).
Mr. Hugo Hirst (chairman of the General Electric Co., Ltd., London).
Mr. Robert W. Paul, London.
Messrs. Scholey & Co., London.
Mr. Hugo Stephens (the Premier Accumulator Co., Northampton).

Municipal Conference.—An International Municipal Conference is to be held at the Anglo-American Exposition, Shepherd's Bush, next week (July 20th to 25th).

The Tramways Congress.—Yesterday morning the Congress of the Tramways and Light Railways Association was opened at Newcastle. The proceedings will be concluded to-day, and will be reported in our next issue.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Torquay Council has resolved to increase the salary of MR. SALT, the borough electrical engineer and manager, from £350 to £400 now, and to £450 from midsummer, 1915, on condition that he gives an undertaking to remain with the Corporation until the works, now contemplated, are completed.

The proposal to advance the salary of MR. TEAGUE, the city electrical engineer, as mentioned in our last issue, was the subject of a long discussion at the Bath Council meeting, and it was eventually carried by 25 votes to 22. One of the arguments against the increase was that the Diesel engine was obtained largely on Mr. Teague's recommendation.

At Bolton Town Council on July 8th, Councillor Knowles moved an amendment to a resolution of the Electricity Committee that the salary of MR. H. E. ANNETT (generating station engineer), on appointment as resident engineer at Back-o'-th'-Bank generating station, be £200 per annum instead of £250, as resolved by the Committee. This was seconded by Councillor Kearns, but lost on a vote being taken.

Mr. F. K. Smith, canvassing engineer in the installation and motor department of the Sheffield electricity works, has resigned his appointment, and in order to fill the vacancy, the general manager (Mr. S. E. Fedden) has suggested a rearrangement (which has been accepted by the Committee), whereby MR. A. W. BUSH, at present canvasser in the publicity department, will be appointed as canvassing engineer at his present salary of £110 per annum ; and MR. A. E. FLETCHER will be appointed to the position vacated by Mr. Bush at a salary of £100 per annum.

In revising salaries the Rotherham T.C. has arrived at the following decisions :—MR. E. CROSS, tramways manager and electrical engineer, present salary of £500 to rise to a maximum of £600 by £50 on January 1st, 1915, and £50 on January 1st, 1917 ; MR. J. WILLIAMS, assistant electrical engineer, £200 maximum reached, with house and light.

On Saturday last the Mayor of Walsall, on behalf of a number of members of the Corporation, presented MR. A. SEDGWICK BARNARD with a heavy silver salver, as a token of their respect and esteem, on the occasion of his resignation of the post of borough electrical engineer. Mr. Barnard also received a large oak clock with Westminster chimes from the heads of the municipal departments, which was presented on their behalf by the town clerk, as well as a suit case and a silver rose bowl from the electricity department, together with other items. He is leaving municipal service in order to take up an appointment with the Chloride Electrical Storage Co., Ltd., and commenced his duties with the latter on July 1st ; his address remains at 5, Victoria Terrace, Walsall, as before.

The Limerick Corporation has granted an increase of £50 per annum to MR. BADHAM THORNHILL, the borough electrical engineer.

MR. A. C. TICEHURST, assistant engineer at Bexhill Corporation electric light works, has resigned. The filling of the vacancy has been referred to Electric Light Committee and Ald. Paton.

The Heywood Corporation has increased the wages of MESSRS. W. A. H. PARKER, HERBERT POTTS and W. A. IRELAND, mains superintendent, steam superintendent, and shift engineer in the electricity department.

With reference to the announcement in our last issue to the effect that Mr. E. Atkinson had been appointed to the position of shift engineer in the Manchester Corporation electricity department, we are informed that Mr. Atkinson withdrew his application, and MR. JOHN A. VICE, along with MR. J. H. NIVEN, was appointed, the commencing salary being £175 per annum, and not £171 as stated by us.

The Ealing T.C. has raised the following salaries of the staff at the electricity works :—P. F. Anley, installation inspector, 50s.—2s. 6d. per week. C. B. Heaviside, shift engineer, 50s.—2s. 6d. per week. S. F. Riddel, shift engineer, 47s. 6d—2s. 6d. per week. F. W. Davey, assistant meter test room, 32s. 6d.—2s. 6d. per week. A. J. Jaynes, assistant meter test room, 32s. 6d.—2s. 6d. per week. T. Southgate, assistant meter test room, 27s.—2s. per week. F. Warwick, meter reader, &c., 27s.—3s. per week.

Tramway Officials.—MR. R. O. PICKMERE has resigned his appointment as general engineering assistant to the West Ham tramways undertaking. The tramways manager (Mr. J. S. D. Moffett) reports that it is not necessary at present to fill the vacancy, but that the case would be met by increasing the wages of the foreman (MR. A. BECKWITH) for the additional duties which would devolve upon him.

The Southport Town Council is to be recommended to increase the salary of the tramways manager from £200 to £250 per annum.

The Ashton Tramways Committee proposes to increase the salary of MR. ERNEST HOLT, tramways manager, from £200 to £250 per annum. An increase is also proposed for MR. F. H. CROSSLEY, storekeeper and general clerk in the tramways department.

General.—MR. E. DOCHERTY, machine shop foreman at the Arc Works, Chelmsford (Crompton & Co., Ltd.), who has resigned his position, has been presented by the employés in his department with a silver flower vase.

MR. W. STANLEY LONSDALE, who has for the past two years been London representative for Messrs. Siemens Bros. Dynamo Works, Ltd., Caxton House, has accepted the appointment of electrical engineer to Messrs. Huntley & Palmers, at Reading. Mr. Lonsdale, who has been with Messrs. Siemens for the last 10 years, four of which were spent in the Far East, takes up his new position early in September.

At St. Paul's Church, Blackpool, on July 9th, Miss Nellie Fielding was married to MR. PERCY J. FRAMPTON, a member of the electrical engineering firm of Bottomley & Frampton, of Blackpool.

MR. A. R. UPWARD has resigned his position as chairman and technical adviser to the Magneta Time Co., Ltd., and has entirely severed his connection with the undertaking.

MR. R. A. PANK, of Messrs. A. Pank & Sons, electricians, of Castle Hall Works, and Bedford Street, Norwich, and his wife, have celebrated their golden wedding, and have been presented by the employés of the firm with an inscribed gilt fruit and flower stand.

Obituary.—MR. S. W. NEWINGTON.—We regret to learn of the death, which occurred on Monday, of Mr. Samuel W. Newington, the borough electrical engineer of Oldham, who had occupied that position since the establishment of the electricity works, over 20 years ago. The deceased, who was 45 years of age, had been ill since last February. He was the son of the late Dr. R. S. Newington, of Goudhurst, Kent.

Wills.—According to the *Financial Times*, the late Mr. A. B. Anderson, (Chairman of the B.E.A.M.A.), who was lost in the wreck of the *Empress of Ireland*, left £6,260 gross, £6,059 net.

CITY NOTES.

Victoria Falls and Transvaal Power Co., Ltd.

THE annual general meeting was held on Wednesday, July 8th, at Salisbury House, E.C., under the chairmanship of the MARQUESS OF WINCHESTER.

The CHAIRMAN, in proposing the adoption of the report (ELEC. REV., p. 1084), dealing first with the balance sheet, said it would be seen that the creditors amounted to £399,447, showing an increase of some £70,000 over the amount owing at the end of 1912. Of this amount £90,656 was in respect of the sums owing to contractors which was retained as a guarantee that the work contracted for should be carried out in the terms of the agreement. The item of £151,315 represented monies in their hands as managers of the Rand Mines Power Supply Co., Ltd. As they knew, the Victoria Falls Co. managed entirely the undertaking of the Rand Mines Power Supply Co. On the other side of the account it would be seen that the Rand Mines Co. owed them £146,666 in respect of profits earned during 1913, since received. The item of leases and concessions and purchase of undertakings again showed a decrease over last year's figure, being £1,561,302 as compared with £1,606,251, the difference being accounted for by the usual charge for depreciation, by certain small items which had been written off, by sales of sundry obsolete plant and by the transfer to its proper account of certain plant and machinery which they thought should not be included under this heading. The item "expenditure on and in connection with power stations, buildings, equipment and land," had been increased during the year by £213,209, and was mostly in connection with the extension they had made to the Simmerpan station; it included buildings, new generating plant and new boiler house and boiler house plant, consumers' sub-station equipments and the necessary overhead transmission lines. The machinery and plant unerected stood at £55,155 as compared with £48,587 at the end of the previous year. This sum represented expenditure on apparatus such as transformers, switchgear and overhead line material which had been ordered to meet the notified demands but which had not at the time of the balance sheet been passed out to the erection department. General stores and spare parts figured at £76,984 as compared with £44,055 last year. It was very necessary in a business such as theirs to keep a large stock of general stores and spare parts in reserve so that the same were always on hand in the case of emergency. Turning to the profit and loss account, the year's operations resulted in an increased profit over the preceding year. In 1912 they carried to the appropriation account £446,380; in respect of the year 1913 they had been able to take £467,823 to the credit of that account, an increase of £21,443. The interest on debentures accounted for £203,920 of this sum and the directors have applied £135,491 towards depreciation, etc., carrying forward £128,411 to the credit of the profit and loss account, increasing that account to £225,198. Out of this amount they had paid a dividend at the rate of 6 per cent. per annum for the six months ended 30th June, 1912, on the preference shares on the 6th January, 1914, and a further dividend at the same rate for the six months ended 31st December, 1912, was paid on the 17th June, 1914. Those two payments accounted for £120,000, so that they had to the credit of the profit and loss account as a reserve at the beginning of the year the sum of £105,198 as against £96,787 last year. The increase in profits of this year could be compared fairly with that which they had the pleasure of laying before the shareholders last year, when the increase in profits was £123,286. This year the increase was represented by only £21,443, a not inconsiderable sum, except by comparison with the previous year. This sum would have been largely increased had normal trading conditions existed on the Witwatersrand during the year under review. In the first instance, they had had a year of abnormal drought; but the first and chief factor in the reduction of increase was the result that in 1912 they brought into commission 34,500 KW. of new plant, whilst in 1913 only 24,000 KW. of new plant came into operation. There was a further cause, and one which was quite beyond their control—the labour trouble which occurred in the previous month of July. In May of the year under review, or for the first five months of that year, their revenue was highly progressive, culminating in May with the high-water mark of power demands by the mines. The actual outburst in the beginning of July was preceded by considerable unrest, which made a perceptible difference to the June returns. Since July, when the exodus of native labourers occurred, the demands of the mines fell rapidly. With each month, as the number of native labourers increased, the demand for electrical energy and compressed air would continue to increase also. As they were aware, there occurred a recrudescence of these disturbances in February last, but, owing to the prompt action of General Botha's Government, the consequences were greatly minimised and, in fact, beyond the month of February showing a natural decrease for the few days of the strike, the remainder of the month proved to be exceptionally profitable to them. Proceeding to deal with criticisms which had appeared in the Press regarding what were said to be the optimistic statements which he made at the last meeting as to the company's future, the Chairman said he thought the severest critic must admit that had it not been for the two causes, namely, the drought and the labour troubles, they would have been in a position to pay off five months of arrears of dividend, which would absorb £50,000, and which would have made the preference dividend then only seven months in arrear. If they were spared the troubles which had upset them in the past year, and if up to 1916 the business of the company should continue as it appeared, then, so far as the repayment of back dividends was concerned, he thought they could go away with confidence that these would be earned and paid, and that they would continue to receive the full dividend of 6 per cent. Many of them would say, "Why not 10 per cent.?" When he made his forecast last year he was not in possession of the mind and intentions of the Union Government. Although he believed that at the present time it was not a law of the land, still there was little doubt that the Finance Bill of 1914 would place upon the company a very heavy burden. The burden was not one which would deprive them of their prosperity, but, so far as they could see, it was probable that it would be represented by a sum in the neighbourhood of £30,000 a year. Under the provisions of the Bill as submitted for second reading, companies earning profits in South Africa were liable to income tax on their net profits after payment of debenture interest. In addition the companies would have to pay over to the South African Government the income tax on the debenture interest with permission, however, to recover the amount so paid, from the debenture holders. Having referred at length to the question of the probable life of the mines on the Rand, the Chairman said he could only assume that statements made by the leaders of the industry, supported by figures given by the Government mining engineer, must be taken as evidence that for a long time to come the supply of payable ore on the Rand would provide suitable employment for the plant which they had provided. Personally, from calculations which he had had got out, he was not anxious regarding the future. Unless renewed prosperity occurred in the mining industry, he thought they were safe in saying that they had sufficient plant installed, or coming into active operation, by the end of this year, to meet all notified demands for some considerable time to come, as well as provide for the amount of spare plant which it was necessary under their contracts that they should provide, and which was an insurance against failure.

Mr. A. BRAKHAN seconded the motion, which was adopted without discussion.

Marconi's Wireless Telegraph Co., Ltd.

THE directors' report for the year 1913 states that the gross profit amounted to £245,584, and the net profit to £122,323. Attention was drawn in the last report to the fact that substantial profit had been realised for the year 1912 under exceptional circumstances, and that the directors therefore deemed it prudent to avail themselves of the opportunity to establish a reserve account, and had appropriated £100,000 from these profits for that purpose. An effective comparison of the results of the two years cannot therefore be made. The directors regret that the business of the past year should not have shown more immediate profits. The company has nevertheless carried out a considerable amount of work, which should contribute large annual revenues in future years. The financial conditions which have prevailed throughout the world for some time past have been responsible for many foreign governments deferring to place orders which the company expected to receive. In other cases the company has been unable to complete contracts within the year owing to delay on that portion of the work which had to be carried out by the governments. The directors recommend the payment of a final dividend for the year 1913, of 10 per cent. on both classes of shares. Summarised, the proposed appropriation of the available balance is as follows:—preference shares: dividend of 17 per cent. for year ended 31st December, 1913, of which 7 per cent. was paid on 1st October, 1913, £42,500; ordinary shares, dividend of 20 per cent. for year ended 31st December, 1913, of which 10 per cent. was paid on 31st January, 1914, £150,000; balance carried forward to next account, £76,550; total, £269,050.

In the balance sheet "Shares in Associated Companies and Patents" are taken into account as usual at their cost price, viz., £1,298,744, an increase over last year of £442,624, the par value of the shares being £2,421,220, showing an increase over last year of £826,637. The amount shown in the balance sheet, and the par value of the shares, show substantial increases over the figures of last year, the company having acquired additional interests which are calculated at cost.

After careful consideration the directors have resolved to discontinue publishing particulars of the shares held by the company, it being in their opinion prejudical to the interests of the company that such information should be made public. Taking the prices quoted on 30th June last for such shares as are quoted on the London Stock Exchange, and placing a moderate valuation on those unquoted (taking into consideration the different elements which they now possess for such valuation), the total value so arrived at represents a sum in excess of the £1,298,744 appearing in the balance sheet. This latter figure also includes the cost to the company of the whole of its patents and patent rights. The cost of patent renewals have been entirely written off from profit and loss account, and no other figure appears in the balance sheet representing either establishment costs or goodwill.

In October, 1913, the capital of the company was increased to £1,500,000 by the creation of 500,000 new ordinary shares of £1 each, ranking for dividends declared in respect of the period commencing the 1st January, 1914, and in all other respects *pari passu* with the existing 750,000 ordinary shares of £1 each. 250,000 shares were forthwith offered to the shareholders *pro rata* at £3 5*s.* per share and the whole of the issue was subscribed and duly allotted. Of the remaining 250,000 shares, 222,688 were issued for cash in December, 1913, in connection with the arangements made with respect to the shares acquired by the Compagnie Universelle de Télégraphie et Téléphonie sans Fils.

The share premium account has increased during the year by 511,958, and now stands at £767,665. Of this amount £397,058 fell due in the early part of this year and has been received.

The Goldschmidt high-frequency alternator (continuous wave machine), in which the company is interested through its share-holding in the Cie Universelle de Télégraphie et de Téléphonie sans Fil, has been erected at a station in Germany and at another near New York. This latter station has been only recently completed and experimental work is being conducted between the two stations. It is yet too early to speak definitely as to the results. A demonstration has been given of the transmission of 3,000 words from America to Germany, when conditions were favourable, but tests from Germany to America on a similar scale have not yet been made. Given that they prove sufficiently promising, work will be proceeded with immediately with a view to making necessary changes and additions to equip both stations on a commercial basis. Some months, however, must be allowed for this work to be completed.

The contract entered into with H.M. Government for the erection of six high-power stations was ratified by Parliament on 8th August last, when the directors contemplated proceeding immediately with the erection of all the stations simultaneously. Additional staff had been engaged and trained in anticipation at considerable expense, but nearly a year has passed, and the board realises that the slow progress which the company has been permitted to make seriously prejudices the company's interests. Much work has been done by the company and a substantial sum of money has been expended, for which no return has been received during the past year. The directors are giving this matter their serious consideration.

The company has continued to do a substantial and remunerative business in Italy, and enjoys the confidence and support of the Italian Government. The erection of the high-power station for the Norwegian Government is well advanced and should be completed by the autumn. A commercial telegraph service between Northern Europe and the United States of America is to be inaugurated, in which this company will be interested to the extent of 10 per cent. of the gross receipts. In December last the Trans-Oceanic Wireless Telegraph Co., Ltd., was incorporated, with a capital of £200,000, for the purpose of conducting a wireless telegraph service between this country and the United States. That company has acquired the new stations which have been erected in Wales for this purpose. These stations will be opened in the near future when for the first time a direct wireless service between London and New York will be established. By this service messages will be automatically transmitted and received at the rate of one hundred words per minute, a speed considerably in excess of the fastest cable. This new service will be conducted by the Trans-Oceanic and American Marconi Companies without the intervention of landlines controlled by any other company. The issued capital of the Trans-Oceanic Co. is held by this company. Telegraph offices will be opened in the City at No. 1, Fenchurch Street, which will be in direct communication by private line with the stations in Wales. Licences have been obtained from the British and Spanish Governments for a direct wireless service between the two countries. For this purpose the company's station at Poldhu has been enlarged, and a service to Spain and the Canary Islands will be inaugurated within a few weeks.

The report gives the following information respecting subsidiary and associated companies:—

THE AMERICAN COMPANY.—Exceptional weather causing considerable difficulty and delay in transport of plant has caused the high-power stations to be longer in course of erection than was contemplated. Those, however, of San Francisco, Hawaii and Belmar (New York), are now practically complete, and will be opened for service in the near future. Difficulty was experienced in securing the services of a man with the knowledge and ability needed for the direction of the American company, and the business of last year was therefore less profitable it is believed than it otherwise would have been. We are glad to be able to report that Mr. E. J. Nally, Ex-Vice-President of the Postal Union Telegraph Co. of America, has become the Vice-President and Manager of the American company. Your directors have had the advantage of receiving two visits from him, and are very hopeful that his business ability and experience in all matters concerning the cable and telegraph business, together with his energetic methods and organising powers, will soon make themselves markedly felt in the development of the American business. The patent actions in the American courts, to which the Chairman referred last year, have now been decided in the company's favour and substantial results should be derived therefrom.

THE CANADIAN COMPANY has made progress during the year and steps which are in contemplation should markedly improve its position in the near future.

THE ARGENTINE COMPANY is proceeding with the construction of the high-power station for communication with Europe, which, so soon as the new transatlantic service is opened, will be pushed on with all speed.

THE BELGIAN COMPANY has continued to earn satisfactory profits and is making substantial progress. For the year ending the 31st December, 1913, a dividend at the rate of 7½ per cent. has been declared. This company now owns and operates nearly 200 ship telegraph stations.

THE FRENCH COMPANY has declared a dividend for the year 1913 at the rate of 10 per cent. on the Ordinary shares, and 31.25 francs per share upon the Founders' shares. This company now owns and operates nearly 100 ship telegraph stations.

THE MARCONI INTERNATIONAL MARINE COMMUNICATION CO., LTD. has shown an increase during the year 1913 of nearly 50 per cent. in its receipts. A final dividend of 5 per cent. has just been declared, making a total of 10 per cent. for the year. This company now owns and operates some 873 ship telegraph stations as compared with 580 at the end of 1912. Our interest in the German Mercantile Marine continues to show excellent progress, and the company receives satisfactory and improving returns therefrom.

THE RUSSIAN COMPANY is making steady and satisfactory progress. It has declared a dividend for the year 1913 at the rate of 6 per cent. The contracts in hand show an increase over those of the preceding year, and the prospects of future business are highly encouraging.

THE SPANISH COMPANY in which the Spanish and General Wireless Trust, Ltd., have large interests, has not made the progress expected. The receipts from their stations, although increasing, are not satisfactory. The terms of their concessions have been impaired by recent legislation, which it is considered entitles the company to substantial compensation. Our managing director has recently paid a visit to Madrid, where he conferred with the Prime Minister and other members of the Government, and informs us that he is encouraged in the belief that the proposals which he has caused to be submitted to the Government will be accepted. In that event the company's position will be distinctly improved, and a reasonable return upon its capital may be expected to follow.

THE BETULANDER AUTOMATIC TELEPHONE CO., LTD., in which this company holds a controlling interest, was incorporated on the 29th August, 1913, to acquire from this company the rights and patents in connection with the automatic telephone system invented by Mr. G. A. Betulander, of Stockholm. The business is being rapidly developed and the directors are confident that it will show substantial and remunerative results.

During the past year this company and its affiliated agents have entered into contracts and executed work for the Governments of the following countries: Great Britain, Dominion of Canada, Indian Empire, Union of South Africa, Bolivia, Brazil, Bulgaria, Chili, Greece, Italy, Norway, Portugal, Rumania, Russia, Servia, Spain, Turkey, and United States of America.

Improvements have been made in some of the types of field station aparatus, notably the lightest form of military apparatus, known as the Knapsack station, which has been entirely re-designed. The sales for 1914 are more than double those of the previous year, and during the early part of 1914 important orders have been received from foreign Governments.

Numerous additional patents, which are believed to be of great value, were taken out during the year.

Rapid progress has been made in the development of wireless telephone apparatus, and the company has recently introduced a practical and commercial set for moderate distances. Further important developments are proceeding and it is contemplated that apparatus will shortly be available for the transmission of speech over considerable distances. The development of this new means of communication should add considerably to the earning powers of the company.

Marked progress has been made during the past year in the development of the Wireless Compass or Direction-finder, and Fog and Submarine Signalling apparatus. These instruments should add materially to the safety of life at sea, and it is hoped they will be universally adopted by the mercantile marine. An apparatus for use in lifeboats has also been recently introduced on the market, and is much appreciated by shipping companies.

An International Convention for Safety of Life at Sea was signed in London on the 20th January, 1914, and a Bill to give effect thereto is now before Parliament. Under this Bill wireless telegraphy is rendered compulsory upon ships carrying 50 or more persons including crew. As similar provisions are to be enforced in all the principal countries of the world, increased business should result for all the subsidiary companies which are operating wireless telegraphy on board ships.

The directors have entered into a provisional agreement with the North British and Mercantile Insurance Co. for the establishment of a Staff Superannuation Fund.

The action brought by Mr. O. Locker Lampson, M.P., and Mr. P. E. Wright, referred to in the last annual report, is still pending. The Chairman will make a statement at the meeting. M. Maurice Travailleur retired from the Board in May, 1914, owing to ill-health. The directors retiring at this meeting, although they would not in the ordinary course retire by rotation, are Commendatore G. Marconi and Mr. Godfrey C. Isaacs, who, being eligible, offer themselves for re-election.

The meeting is to be held on Tuesday next, July 21st.

Edmundson's Electricity Corporation, Ltd.

THE annual meeting was held on July 9th at Salisbury House, E.C., under the presidency of Mr. P. D. TUCKETT.

In proposing the adoption of the report (ELEC REV., p. 66), the CHAIRMAN said that during the past year the progress of the company had been well maintained, both in the growth of the business and in the profits earned. The connections had increased by the equivalent of 169,699 33-watt lamps, the largest annual increase they had ever secured, and practically double that of five or six years ago. Whether they would be able to maintain that rapid rate of increase he very much doubted with trade tending to become less active and with the smaller capital expenditure they were now making, but he saw no reason to suppose that the business would not con-

tinue to show a healthy and satisfactory growth from year to year and, indeed, so far this year their connections were somewhat in excess of those for the corresponding period, the lighting connections in particular being substantially up. An equally satisfactory increase of over 6¼ million units was shown in the output, the lighting units having increased 5 per cent. and the power units 33 per cent. The profits of the various undertakings had increased by £11,460, which, though not quite so large an increase as in the previous year, when they were up £12,414, was largely in excess of the increases for 1910 and 1911, and was by no means unsatisfactory when they took into consideration the phenomenally fine summer last year as compared with one of the vilest summers on record the previous year. Indeed, so marked was the contrast that for the summer quarter of 1913 they actually earned less profit than in the previous summer quarter. Moreover, coal cost them over £3,500 more owing to higher prices. In this respect, however, he was glad to say that they were at last likely to find some relief since most of their coal contracts were now being renewed at somewhat reduced prices, the benefit of which they would feel this year and next. Of this increased profit of £11,460, £2,561 had been received in the form of extra dividends and interest, but owing to the redemption of the prior lien debenture stock in 1912 they had lost the interest which appeared in last year's accounts on the temporary investments and cash loans. Consequently, the net increase in the item of dividends and interest was only £1,640, but, as he had previously explained, they could not expect to receive more than a comparatively small proportion of the additional profits earned by the subsidiary companies until the Urban Co., with far the largest capital of any of them, was in a position to resume payment of dividends on its ordinary shares, of which they held more than half. The yield on their investments was, however, steadily progressive, being at the rate of 3.24 per cent. last year as compared with 3.06 per cent. for 1912, 2.71 per cent. for 1911, 2.38 per cent. for 1910, and 2.19 per cent. for 1909. This clearly indicated the steady improvement which was taking place in the position of the company, although the yield was admittedly still far from adequate, thanks largely to the fact that something like £400,000 of their investments was still bringing in no return at all. The figure of £45,297 representing dividends and interest compared with the figure of only £24,087 six years ago, and during the same period the annual reserve provisions made by the subsidiary companies had been increased by over £26,000. It would be seen therefore that not only was the position of this company being steadily improved, but the position of the subsidiary companies was at the same time being correspondingly strengthened. There was an increase of £911 in the gross trading profit and an increase of £4,226 in the net profit of £23,125. They proposed to place £9,000 to reserve, £12,000 to the payment of the dividend for the year on the cumulative preference shares, carrying forward the balance of £2,125. For reasons which he had often explained, their trading profits could not safely be regarded as being to anything but a small extent available for distribution. They were perfectly legitimate profits, and ultimately they would reap the benefit of them, but until that time arrived they were not going to repeat the mistake, which contributed to bring about the disastrous position in which the company found itself some seven years ago, by treating them as immediately distributable. Turning to the balance sheet, the Cromer undertaking now appeared along with the Frome undertaking under the heading of undertakings owned by the Corporation. Although the Cromer undertaking shared with Frome the unenviable distinction of being amongst their least profitable undertakings, there was no question as to the advantage of their owning it in preference to the previous arrangement. The item of work in progress, which stood at £10,098 as compared with £6,420 a year ago, indicated that they had made a favourable start for the current year in their trading business. The shrinkage of nearly £13,000 in their cash resources was not so satisfactory, but it was entirely attributable to the unprecedented financial conditions which had rendered it inexpedient to replenish their resources. Consequently, until times improved, which he thought would certainly be the case if only the Ulster question was once disposed of, they were restricting capital expenditure within as narrow limits as they reasonably could. On the liabilities side the reserve had been increased by about £16,000, a most satisfactory feature of the accounts. With regard to the gross profits of the subsidiary companies, most of them showed some improvement, and in the few instances where this was not the case, the apparent want of improvement was accounted for by some specially heavy repair or other equally definite explanation. It might interest them to know that in the all-important feature of return on capital the aggregate yield shown was steadily progressive, being at the rate of 5.2 per cent. as compared with 4.9 per cent. for 1912 and 4.7 per cent. for 1910. The Lancashire Power Co. continued to make steady progress, its profits having increased during the year from about £15,000 to nearly £23,000, whilst the directors reported that the outlook for the present year was distinctly encouraging. In conclusion, he had only to say that with the one exception of the difficulty experienced in raising fresh capital without undue sacrifice under the adverse conditions which had recently prevailed, and which had equally affected other similarly situated industrial concerns, and from every other standpoint except that of immediate dividends, the position of the company was increasingly satisfactory and its prospects were steadily improving.

Mr. A. A. Campbell Swinton seconded the motion, which was carried unanimously.

In proposing the re-election of the Chairman as a director, Mr. Swinton said that the improvement which had taken place in the position of the company was due in a very large degree to the work of Mr. Tuckett.

The motion was carried, and the Chairman, in thanking the meeting for his re-election, remarked that he had received the loyal support of his colleagues and Mr. Highfield (their Advisory Engineer) in carrying out his duties. It was not possible for any one man to get the company out of the difficulties into which it got some years ago, but as he had said on previous occasions, he believed it only needed continued patience for the shareholders to ultimately receive an adequate return on their holdings.

Crompton & Co., Ltd.

Mr. C. F. Tufnell presided at the annual meeting held on Monday at Salisbury House, E.C. In moving the adoption of the report (Elec. Rev. p. 67) he congratulated shareholders upon the very decided improvement in the business, an improvement which they predicted as the inevitable result of putting their house in order. The new capital had been a great help, but as they only received the last instalment three months before the close of the accounts, they had not yet reaped the full benefit. Not only had the capital been reorganised, but they had also made considerable changes in the organisation of the business, and with satisfactory results. This had involved a large amount of work which had been done without dislocation of business. The question of debentures had given the directors certain anxiety since the last meeting. Acting on the advice of eminent counsel, they proposed to keep the debentures of the old company in force, but certain debenture holders in February considered that the company was wrong in that respect, and applied to the Court, resulting in a decision in the debenture holders' favour. The difficulty was overcome by a scheme of arrangement continuing the debentures in force, but the directors thought it expedient to increase the interest from 5 to 5½ per cent. The necessary majority was obtained at the meeting of the debenture holders called to approve the scheme, and in due course the sanction of the Court was obtained and the scheme made binding. The profit made during the year, after deducting various charges, including interest on debentures, etc., was £13,551. Shareholders might suggest that that would warrant a more liberal distribution than they proposed, but the directors felt strongly that a conservative policy must be adopted from the commencement and every effort made to strengthen their position. The present balance sheet could not be compared with that of the old company as a good many changes had taken place. The whole 136,000 preference shares had been issued, and the 7s. 6d. liability thereon at the time of issue had been paid up. The first mortgage debentures remained, as in the case of the old company, at £100,000. On the other side of the account the first item was the balance of the purchase price of the business, after deducting assets separately valued. They had had to leave in this first item the shares in the Auxiliary Electrical Co., which might one day be worth something appreciable, but their present value could not be ascertained. The face value of the shares was some £42,000, and this sum represented amounts paid under a guarantee of the earnings of the Electric Supply Corporation, and the Auxiliary Electrical Co., which was entirely owned by this company, was entitled to be repaid the amount so advanced out of the surplus profits of the Electric Supply Corporation. The Corporation was at present paying a small dividend, but was yet some distance from earning sufficient to entitle the Auxiliary Co. to any return. The directors had not separately valued a claim arising out of a contract with the P.W.D., Madras, which had been the subject of litigation. The decision of the Court of first instance in Madras was largely against the company, but the decision of the Madras Appeal Court was entirely in the company's favour. It would take some time to ascertain the amount due to the company, which included damages and interest, and there was always the possibility of an appeal to the Privy Council. The stock-in-trade and work in progress had been carefully valued. With regard to sundry debtors, provision had been made for the possibility of bad debts. The investments in other companies were of small amount, and were valued on a conservative basis. The preliminary expenses represented the cost of the registration of the company, underwriting and other expenses, and their idea was to write these off in three years. There was a note on the balance sheet with regard to liability in respect of cost of liquidation. This was not an important matter, but as the liquidation accounts were not finally closed they were obliged to refer to it. The note on the other side of the balance sheet in regard to liability of shares referred to the Auxiliary Electrical shares, but there was no possibility of any further monies being called on those shares. Turning now to the profit and loss account, they had spent considerable sums in maintenance, repairs and renewal of plant, tools and premises, all of which had been charged against revenue. They had charged depreciation at the usual rates, and provided for the possibility of bad debts. As to the future, he could not forecast the course of trade, but the prospects for the current year were good. Further, not only was this business on a much sounder footing than formerly but, in his

opinion, this remark would also apply to the electrical trade as a whole, and he thought they were not likely to see a return of the insensate price-cutting which prevailed in former years. One of the directors, Mr. Hale, had recently returned from a visit to Australia, and he spoke well of the prospects of the business in the company's manufactures in that Colony, and of the energy and ability of the company's Australian manager, Mr. E. J. Erskine. The Chairman finally referred to the excellent work done, both during the reconstruction and subsequently, by Mr. Edwin Reeves, the managing director, and he was to be congratulated upon the condition in which the new company found itself. He also bore witness to the improved work at Chelmsford, where their new works manager, Mr. Britten, had done and was still doing yeoman service. The whole staff at London and Chelmsford, and the branches, had been most loyal to the board, and were deserving of the thanks of the shareholders.

The report was adopted.

Prospectus.—*Southern Brazil Electric Co., Ltd.*—The list was to close on Wednesday in an issue of £570,000 6 per cent. mortgage debentures at 98 per cent. in this company, which was formed in March last year to acquire the control of and to develop certain electric supply and other public utilities in Brazil. It is acquiring over 99 per cent. of the issued share capital of a company which has the power, lighting and traction exclusive concession until 1946 for the City of Campinas and the villages of Vallinhos Souzas and Laranjal; also 70 per cent. of the capital of a company which has a 30 years' exclusive concession for electric supply in the town of Amparo; a 14 years' (remaining) concession for the lighting in the City of Piracicaba (an extension of 30 years, including a tramway, is being applied for); over 99 per cent. of the capital of the Paranagua company which has a 30 years' electric light and water concession for Paranagua; and a one-half interest in the firm of Byington & Co., of Sao Paulo, Santos and Rio Grande do Sul, who carry on business as electrical engineers and contractors. The populations and the estimated profits of the four undertakings and the firm, for the year ended December, 1913, are given as follows:—Campinas, 45,000, profit £45,165; Amparo, 12,000, profit £3,610; Piracicaba, 18,000, profit £12,026; Paranagua, 10,000, profit £3,484; Byington & Co., profit (50 per cent.) £9,448. The valuation of the properties as going concerns is put down at £1,056,500, the profit for 1913 at £73,733, and the estimated capital outlay for the next three years at £190,500. It is estimated that the various properties will receive remarkable benefit by consolidation, and the income for the three years, 1914, 1915 and 1916, is estimated at £96,860, £114,700 and £142,800 respectively.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—The directors have declared an interim dividend of 2½ per cent. on the ordinary shares.

Direct United States Cable Co., Ltd. — Interim dividend, 2s. per share, being at the rate of 4 per cent. per annum, for the quarter ended June 30th, 1914.

Anglo-American Telegraph Co., Ltd. — Interim dividends for the quarter ended June 30th, 1914, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock.

British Columbia Electric Railway Co., Ltd.—Dividend at the rate of 5 per cent. per annum on the preferred ordinary stock for the June half-year, together with an additional 1 per cent. per annum for the same period.

STOCKS AND SHARES.

Tuesday Evening.

The immediate factor in Stock Exchange markets, at the beginning of this week, was the renewed recrudescence of the Ulster crisis. This dominated everything else, and the strenuous efforts of the newspapers in the direction of calming popular passions and sternly refusing to print a single line of inflammatory flummery, were the subject of general comment. In spite of this remarkable restraint on the part of the ink-slingers, some people went evidently frightened at the outlook, and Consols fell with a sharp drop, to recover later on. Minor sensations include the issue of the Marconi report, a slump in Brazil Tractions, and a notable rally in confidence as regards Mexican Railway matters.

Marconi shares experienced a formidable fall on the issue of the report. The dividend is made up to 20 per cent., as before, but the figures show so heavy a reduction, in net profits, as to cause grave disappointment. At one time, the parent shares were offered at 39s. 9d., but the usual reaction occurred. On the week the loss shown overleaf is 10s., and it has to be remembered that the present price of 2 1/16 compares with 3¼ touched only three weeks ago. With the slump in the Ordinary shares there has also come, of course, severe shrinkage in the Preference, while Americans and Canadians gave way to 10s. 9d. and 5s. 6d. respectively.

It must be admitted that the company's figures make a very poor display against those of a year ago, and are worse than most people expected them to be. The 1912 profits were admittedly swollen by special circumstances, but normal expansion of the business should have made up partially for the extra money brought in by sales of shares in last year's accounts. Next week's meeting promises to be a lively affair, for both the Commendatore himself and Mr. Godfrey Isaacs have voluntarily offered to retire from the board, seeking re-election, as to the result of which there is not much doubt.

The critic may be excused for venturing the opinion that the board would have been better advised had they declared less dividend and retained the money for the building up of the reserve funds. Such a course would, at least, have had the effect of lessening the chance of rumour-mongers toying with guesses at possible new issues—a chance which, to the Stock Exchange mind, will be present for some time to come.

Lively discussion, too, is raging round the proposals of the British Electric Traction Company. The main part of the opposition springs from holders of the 7 per cent. non-cumulative Preferred stockholders, some of whom consider themselves badly-used in the suggested reorganisation. The directors, we understand, are anxious to deal with all the classes of proprietors as strictly equitably as possible, but their task was obviously difficult, and any scheme must have aroused resentment where sacrifice was inevitable. The terms, of course, are not settled yet, and it may be taken for granted that alternatives will receive fair, and impartial, consideration. Market quotations for the three junior stocks are 1 to 2 higher on the week.

Underground Railway issues have given way, and so have steam stocks, the declines in the latter being associated with Ulster apprehensions. More intimate causes affected Districts and the shares of the Underground Electric Railways Company, because the House of Lords Committee has passed the Bill of the Middlesex Council for putting a tax of ⅜ths of a penny per car-mile on the motor-'buses, using certain highways, by way of contribution to the new Bath Road. That other bodies will follow suit is more than likely, and this will cut into the profits of the group's most prosperous unit, the London General Omnibus Company. That something of this kind was bound to happen, it has been frequently urged here, and especially a year or two back when 'Bus "A" shares were being "tipped" with such vigour at 13s. Their present price is about 8s. The company's £10 shares are 5s. down. No doubt the next step will be a revision of fares in the upward direction.

Excited rises in Mexican Railway stocks followed an order from the Mexican Government that the company should repair a gap in the line made previously, under the same authority, to check intercommunication by train between the rebels. This was read as an inference that the Mexican Government considered the insurrection to be ending, but Utility issues failed to share the strength of the Railway Market. Mexico Trams and Mexican Lights are both easier. Both of these command large Continental followings, and the Brazilian slump has so upset Paris and Brussels that lines of other stock came on offer from those centres. Brazilian Tractions felt the chief force of the Belgian selling. The price is down 5½. Rio Tramway bonds, too, are lower.

Montreal Light and Power Common has gained 6 points in spite of severe spasms of flatness in Canadian Railway descriptions. Canadian Generals rose 2, but lost the gain afterwards.

The Indian shares are good. Rises of 7s. 6d. in Calcutta Trams, 2s. 6d. in Calcutta Electric Supply and in Rangoon Preference have come about as a consequence of continual investment in the shares by Anglo-Indian banks on behalf of their Indian customers. Bombay Second Debenture is a point lower, though the Firsts gained 1. Lisbon Tramways Preference rose to 1½, but Barcelona Tractions have been very flat, dropping to 18. In view of recent lavish advertising, the slump in these shares may appear perplexing. The recent issue of bonds is called normally 78. It was offered, of course, at 82½.

Home Electricity Supply securities are very quiet. Kensingtons slipped back, and Metropolitans rose ½. Otherwise there is not a quotable change worth mentioning. Nobody expects this market to become illuminated in the summer time, and in many cases there is not so much as a solitary transaction per diem. When public interest revives, there are several fresh names to be added to our price-list; as market conditions are at present, the catalogue might be reduced by one-half and still contain twice as many issues as the investor is paying heed to just now.

Telegraphs are steadily mounting in price. On top of gains last week have come others in the Anglo-American, Eastern and Trust Companies' groups. Eastern Ordinary and Preference have recovered dividend deductions: China shares did better still. Indo-Europeans are 20s. up. Western Union bonds advanced 2. The whole market is somewhat short of stock, while the investor is keen on having what there is. West India and Panama Ordinary are an exception, shedding another 1/16, so that on the basis of the last dividend, the present return is 9 per cent. on the money.

The strength of cable shares has spread to those of the manufacturing companies. Telegraph Constructions regained their 12s. dividend. British Insulated Ordinary put on 12s. 6d.; the Preference, with India-Rubber Preference, rose 2s. 6d. Other shares are very firm. Rubber issues improved a little on the hardening of the produce.

Six per cent. debentures have been offered this week, at 98, by the Southern Brazil Electric Company, a bonus of 10 per cent. in shares accompanying the bonds, which look a speculative security. The Manila Electric Railroad publishes a report showing good progress, and earnings of about 12 per cent. on the Common shares, which receive 7 per cent. Less satisfactory is the report of the Alabama Traction, Light and Power Company, wherein the opinion is expressed that by the end of this year the concern will be making enough net revenue to cover fixed charges and operating expenses. The 5 per cent. bonds stand at 67. Manila capital stock is quoted at 102, and the 5 per cent. bonds at par.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	..	⅛ — ¼	..	Nil
Do. 5 % Pref.	1	5	5	3/32 — 5/32 xd	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	17 — 19	+½	..
Do. Do. Deferred	100	..	..	10 — 12	+2	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 — 89	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	8	3½	54 — 57 xd	+1	6 2 10
Do. 5 % Perp. Deb.	100	5	5	91 — 93	..	5 7 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 79	..	5 14 0
Central London Railway, Ord.	100	8	8	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 8
Do. Pref.	100	4	4	68 — 78	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	95 — 97 xd	..	4 2 6
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	+9 — 92	..	5 5 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref.	1	6	6†	⅜ — ⅝	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	84½ — 86½	..	5 15 4
London and Suburban, Ord.	1	..	..	5/32 — 7/32	+1/32	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅛ — ¼	..	8 0 0
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79	..	5 14 0

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c. £ s. d.
London Elec. Railways, 4 % Deb.	* 100	4	4	88 — 90	..	4 9 0
London United Trams, 4 % Deb.	100	4	4	54 — 58	..	6 18 0
Metropolitan Railway Consol.	100	1⅞	1⅞	40½ — 41	— ½	3 19 3
Do. Surplus Lands	100	2⅜	2⅜	62 — 64	+1	4 6 0
Do. 3½ % Deb.	100	3½	3½	86 — 88 xd	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	79 — 81	..	4 6 4
Metropolitan District Ord.	100	Nil	..	25½ — 25⅞	..	Nil
Do. 6 % Deb.	100	6	6	126 — 129	..	4 6 0
Do. 4 % Deb.	100	4	4	91 — 93	..	4 6 0
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 86	..	5 4 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3¼	3½	3/32 — 5/32	..	8 12 10
Do. 5 % Pref.	1	5	5	3/32 — 5/32	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81½ — 84½	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Underground Elec. Railways	10	..	..	2⅞ — 3⅛	— ⅛	Nil
Do. "A"	1/-	..	..	1/32 — 1/16	— 1/32	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	116 — 118	..	5 1 7
Do. 4½ % Bonds	100	4½	4½	99 — 101	+1	4 9 0
Do. 6 % Income	100	6	6	90½ — 91½	..	6 11 2
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/32 — 3/32	..	Nil
Do. 6 % Pref.	5	8	4	4⅛ — 4⅜	+ ⅛	4 6 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 5	..	5 10 0
Do. 2nd Pref.	5	5½	5½	4⅛ — 4⅜	..	6 5 9
Do. 4 % Deb.	100	4	4	90 — 93	—1	4 7 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
Do. 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Auckland Trams, 5 % Deb.	100	5	5	101 —104 xd	..	4 16 8
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11¼	..	5 2 2
Do. 4½ % Deb.	100	4½	4½	96 — 97	+1	4 12 9
Do. 5 % 2nd Deb.	100	5	5	99 —101	—1	4 19 0
Brazilian Traction, Light and Power	$100	6	6†	72 — 74	—5/8	8 2 2
Brisbane Trams Invt., Ord.	5	8	8	7⅛ — 7⅜	+ ¼	5 8 3
Do. 5 % Pref.	5	5	5	4⅞ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	99 —101	+1	4 9 0
B. Columbia Elec. Rly., Def.	100	8	8†	106 —110	— ½	7 5 6
Do. Pref. Ord.	100	6	6	103 —107	..	5 12 1
Do. 5 % Pref.	100	5	5	102½ —105¼ xd	..	4 14 7
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 0
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	95½ — 97½	..	4 7 2
Calcutta Trams, Ord.	5	7½	9½	6⅝ — 7⅜	+ ⅛	6 8 9
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
Cape Electric Trams	1	5	5	1/32 — 3/32	..	6 13 4
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5⅝	+ ⅛	4 9 0
Do. 4 % Deb.	100	4	4	95 —100	..	4 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	91 — 95	..	5 5 3
Havana Elec. Rly., 5 % Bonds	$1000	5	5	91 — 95 xd	..	5 5 3
Kalgoorlie El. Trams 5% A Deb.	100	5	5	82 —87	..	5 15 0
Do. 6% B Deb.	100	3	..	10 — 20	..	Nil

La Plata Elec. Trams, Ord.	1	..	..	⅛ — ¼	..	..
Do. Pref.	1	4½d.	6	3/32 — 5/32	..	6 5 0
Lisbon Elec. Trams, Ord.	1	6	6	1⅛ — 1⅛	..	4 9 8
Do. 6 % Pref.	1	6	6	1⅛ — 1⅛	+3/32	4 16 0
Do. 5 % Deb.	100	5	5	92½ — 97½ xd	..	5 2 6
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	99 —101	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	75½ — 78½	..	6 7 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ —100½	..	4 19 6
Mexico Trams Com	$100	7	7	71 — 75	—1	..
Do. Gen. Con. 5 % Bonds	..	5	5	80 — 84	..	5 19 1
Do. 6 % Bonds	100	6	6	73 — 77	—1	7 16 10
Para Elec. Rlys. & Lt., Ord.	5	10	10	4 — 4½	..	11 2 2
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	88 — 91	+ ½	5 10 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	+ ⅛	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94 — 96	..	4 13 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	96½ — 98½	—1	5 1 6
Do. 5 % Mort. Bonds	100	5	5	88½ — 90½	—1½	5 10 8
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 —101	..	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video	5	7	7	4⅞ — 5⅛	..	7 7 4
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 17 3
Do. 5 % 1st Deb.	100	5	5	96 — 97	..	5 3 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 8

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9⅝ — 10⅜	..	4 5 9
Do. Second 6 % Pref.	10	6	6	10⅝ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	10	8⅜ — 9⅛	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	91 — 94	..	4 5 1
Charing Cross, West End & City	5	5	6	4⅞ — 5⅛	..	5 11 7
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅝	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 15/16 — 4 31/32	..	4 18 8
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	5	4¾ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	95 — 98 xd	..	4 11 0
City of London, Ord.	10	9	10	16 — 17	..	5 17 8
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	115 —118	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	98 —101	..	4 9 1
County of London, Ord.	10	6	7	11⅞ — 12¼	..	5 14 3
Do. 6 % Pref.	10	6	6	11¾ — 12⅛	..	4 17 0
Do. 4½ % Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 1
Edmundson's, Ord.	£3	..	..	3/16 — 5/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4 xd	..	7 10 0
Do. 6 % Non-Cum. Pref.	5	..	..	1⅝ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	81 — 84 xd	..	5 7 2
Folkestone	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 14 9

Hove	5	8	9	8½ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7⅛ — 7⅜	— ⅛	5 16 8
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	73⅜ — 77⅜ xd	..	5 15 9
London Electric, Ord.	3	2⅜	3	1⅜ — 1⅝	..	5 10 7
Do. 6 % Pref.	5	6	6	4⅝ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4½	4½	3⅜ — 3⅝	+ ⅛	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99	..	4 11 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	82 — 84	..	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10⅛	..	5 17 3
Oxford	5	7	7	6⅞ — 7⅛	..	5 10 0
St. James' and Pall Mall, Ord.	5	10	12	9⅝ — 9¾	..	6 4 8
Do. 7 % Pref.	5	7	7	6¾ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	82 — 86	..	4 2 4
South London, Ord.	4	5½	5½	2⅞ — 3⅛	..	6 10 4
Do. 5 % First Mort. Deb.	100	5	5	93 —101	+1	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/16 — 1 5/16	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	3/32 — 5/32	..	..
Do. 5 % Cum Pref.	5	3½	4	2¾ — 3	..	6 13 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 8
Westminster, Ord.	5	10	10	8⅜ — 8¾	..	5 12 ..
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 6 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£5	6	6	5⅛ — 5⅜	..	£ s. d. 5 11 7
Calcutta, Ord.	£5	8½	9	7½ — 7⅝	+ ⅛	5 16 2
Do. 5 % Pref.	£5	5	5	5 1/16 — 5 3/16	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	87 — 89	..	5 12 3
Canadian Gen. El. Com.	$100	7	8	98 —108	..	7 15 6
Do. 7 % Pref.	$100	7	7	116 —121	..	5 15 10
Cordoba Lt., Power and T., Ord.	£1	5	..	7/16 — 1/2	..	7 12 0
Do. 5 % Deb.	100	5	5	80 — 85	..	5 17 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	82 — 83	+1	8 19 6
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/9 — 4/-	..	Nil
Do. 6 % Pref.	£1	6	4	1/4 — 3/8	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	99 —102	..	4 18 0
Madras, Ord.	£5	Nil	..	1⅛ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 —106	..	4 14 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	58 — 63	..	7 18 8
Mexican Lt. & Power, Common	$100	4	4†	45 — 48	—1	..
Do. 7 % Cum. Pref.	$100	7	7	71 — 75	—2	9 6 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	76 — 81	..	6 3 5
Do. 5 % 2nd Mort. Bonds	100	5	5	59 — 64	..	7 13 3
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	100	5	5	48 — 53	..	..
Montreal, Lt., H. and Power	$100	9	10†	236 — 241	+6	4 3 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	10	235 —245	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 —103	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	99 —101	..	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	132 —137 xd	—3	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103 —106	..	4 14 4
Do. 4½ % Per. Deb.	Stock	4½	4½	100 —102	..	4 8 3
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	98 —100	..	4 10 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	82½ - 84½	..	5 18 4
Victoria Falls Power, Pref.	£1	6	6	1/16 - 3/16	..	8 0 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	£1	7	7	11/16 — 13/16 xd	..	£ s. d. 8 12 4
Do. 6 % Pref.	£1	6	6	13/16 — 15/16 xd	..	7 2 3
Babcock & Wilcox	£1	16	16	3¼ — 3⅜	+ 1/16	5 6 8
Do. Pref.	£1	6	6	1 5/8 — 1 7/8	..	4 8 6
British Aluminium, Ord.	£1	..	5	1 3/16 — 1 5/16	..	4 14 1
Do. 6 % Cum. Pref.	£1	6	6	1 3/16 — 1 5/16	..	6 9 0
Do. 5 % Prior Liens Debs.	100	5	5	95 — 98	..	5 2 0
Do. Deb. Stk.	100	5	5	90 — 95	..	5 5 3
B.I. & Helsby Cables	£5	10	13	10 — 10⅜	+ ⅛	6 13 8
Do. Pref.	£5	6	6	6 — 6⅛	+ ⅛	4 12 4
Do. Deb.	100	4½	4½	100 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	92 — 94	..	4 15 9
British Westinghouse, Pref.	£2	Nil	5	1⅝ — 1⅞	..	5 6 8
Do. Deb.	100	4	4	73 — 76	..	5 5 3
Do. 6 % Prior Lien	100	6	6	101 —104	..	5 16 6
Browett, Lindley, Ord.	£1	..	..	2/- —3/-	..	Nil
Do. Pref.	£1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	80 — 85	..	5 17 8
Do. 4½ % Deb.	100	4½	4½	52 — 57	..	7 17 10
Do. 4½ % Second Deb.	100	4½	4½	29 — 33	..	13 12 8
Callender's Cable	£5	15	15	11¼ — 12½	..	6 2 5
Do. Pref.	£5	5	5	5 — 6⅛	..	4 15 3
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	£1	20	22½	2 7/16 — 2 9/16	..	8 15 5
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Dick, Kerr	£1	Nil	..	3/16 — 5/16	..	..
Do. Pref.	£1	6	6	1 — 1⅛	..	6 17 2
Edison & Swan, A, £2 paid	£5	Nil	..	1/16 — 3/16	..	Nil
Do. fully paid	£5	Nil	..	1/8 — 1/4	..	Nil
Do. 4 % Deb.	100	4	4	57 — 61	..	6 11 1
Do. 5 % Second Deb.	100	5	5	61 — 66	..	7 11 6
Electric Construction	£1	5	6	3/16 — 7/16	..	8 14 6
Do. Pref.	£1	7	7	1 — 1⅛	..	6 4 5
Greenwood & Batley, Pref.	£10	7	7	6½ — 7½	..	9 18 9
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£10	6	6	10⅜ — 10⅞	..	5 10 4
Do. Deb.	100	4	4	88 — 92	..	4 7 0
Henley's, Ord.	£5	15	20	14½ — 15½	..	6 9 0
Do. Pref.	£5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
India-Rubber, G. & T.	£10	7½	7½	9½ — 10⅜	..	7 2 10
Do. Pref.	£10	5	5	9 — 9⅞	+ ⅛	5 3 7
Telegraph Construction	£12	20	20	87½ - 89½ xd	+ ½	6 1 7
Do. Deb.	100	4	4	97 — 99	..	4 0 10
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	..	69 — 67	..	5 19 8
Do. B 4 % Cum. Pref.	100	..	£4	38 — 42	..	9 10 6

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations July 14th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	£10	4½	4½	6⅝ — 6¾	..	£ s. d. 7 4 0
Do. 5 % Deb. Red.	Stock	5	5	95 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8	121 —125	..	6 8 0
Do. Collat. Trust	$1000	4	4	91 — 94	..	4 5 0
Anglo-American Telegraph	Stock	8	8	64 — 67 xd	+ ½	4 9 7
Do. 6 % Pref.	Do.	6	6	107½ -109½ xd	+1	5 10 11
Do. Def.	Do.	80/-	80/-	22⅝ - 23⅝	+ ½	6 7 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	£5	8	6†	7⅛ — 7⅜	..	5 6 8
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80½ — 82½	..	4 17 0
Cuba Telegraph	£10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	£10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	£5	4	4	3½ — 4	..	5 0 0
Do. 10 % Cum. Pref.	£5	10	10	7⅛ — 7⅝	..	6 9 0
Direct United States Cable	£10	4	4	6⅝ — 7⅛	+ ⅛	5 12 8
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	130 —133 xd	+1½	5 5 8
Do. 8½ % Pref. Stock	Do.	8½	8½	76 — 78 xd	+ ⅛	4 9 9
Do. 4 % Mort. Deb.	Do.	4	4	95½ — 97½	..	4 2 1
Eastern Extension	£10	7	7	128⅜ — 131½ xd	+ ¾	5 6 9
Do. 4 % Deb.	Stock	4	4	96 — 98	+ ⅜	4 1 8
Globe Telegraph and Trust	£10	6	6†	11 — 11½	+ ⅛	5 4 4
Do. 6 % Pref.	£10	6	6	12½ — 13	+ ⅛	4 12 4
Great Northern Telegraph	£10	20	20	91½ — 93½	..	5 19 5
Indo-European Telegraph	£25	18	18	58 — 60	+1	5 8 4
Mackay Companies Common	$100	5	5	80 — 85	..	5 17 8
Do. 4 % Cum. Pref.	$100	4	4	67 — 72	..	5 10 1
Marconi's Wireless Telegraph	£1	20	20	2 — 2⅛	— 1/16	9 8 2
Do. 7 % Cum. Partic. Pref.	£1	17	17	1 7/16 — 1 11/16	— 1/8	10 1 8
Monte Video Telephone, Ord.	£1	6	6	13/16 — 15/16	..	6 8 0
Do. 5 % Pref.	£1	5	5	29/32 — 31/32	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100½ - 101½	..	4 9 0
Oriental Telep. and Elec.	£1	10	10	2 1/16 — 2 3/16	..	4 7 6
Do. 6 % Cum. Pref.	£1	6	6	1 5/8 — 1 3/4	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	86 — 88	..	4 11 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	95 — 97	—1	4 2 8
Reuter's	£10	10	7	7½ — 8¼	..	8 9 8
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 — 99	..	4 11 0
United River Plate Telephone	£5	8	6†	6½ — 6⅝	..	6 0 9
Do. 5 % Cum. Pref.	£5	5	5	5 — 5⅛ xd	..	4 11 0
West Coast of America	£2½	2½	N	¾ — 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	£10	1½	1½	1⅛ — 1⅜	— 1/16	9 1 10
Do. 6 % Cum. 1st Pref.	£10	6	6	6⅜ — 9½	..	6 9 9
Do. 6 % Cum. 2nd Pref.	£10	6	6	8⅛ — 8½	..	6 16 9
Do. 5 % Debs.	100	5	5	98 —101	..	4 19 0
Western Telegraph, Ltd.	£10	7	7	13⅜ - 13⅞	..	5 0 11
Do. 4 % Debs.	Stock	4	4	97⅛ — 97⅜	..	4 2 1
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	95 - 100	+2	4 10 0

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

Jacks on Tramcars.—At an inquest held at Manchester into the death of a two-year old child, whose body was found beneath the lifeguard of one of the Corporation tramcars, it was stated that the jack would not lift the car, and the public got round and lifted it bodily so that the dead child might be removed. The Coroner said that he had had case after case where these jacks had been called into question. They never seemed to be of any use. He did not know why they were carried. The jury, in returning an open verdict, expressed the opinion that the Corporation should take the jacks into consideration, especially after the number of cases which had occurred reflecting on their efficiency. Mr. Derbyshire, who appeared for the Tramways Committee, said that the jacks were quite strong enough to lift the cars, and they ought to do so. It was suggested that on such occasions drivers got excited. The Coroner replied that that might be so, but drivers should be so drilled in the use of the jacks that their operation would become automatic.

E.H.T. Testing Transformers for Japan.—Two testing transformers, having a normal rating of 360,000 volts continuously, and 500,000 volts for short periods, have recently been installed by the Inawashiro Hydro-Electric Power Co., one being located at the generating station on the Nipashi River, at the outlet of Lake Inashiro, about 145 miles from Tokio, and the other in the receiving sub-station in Tokio. The machines, which were built by the Westinghouse Co., of Pittsburg, U.S.A., are intended to be used for testing the transmission lines and apparatus in the stations. Among the features of interest in the transformers are the arrangement of the windings to give distributed static fields, the use of condenser terminals to give distributed stresses from terminals to earth, and the terminal "hat" to distribute stresses from terminal tip to earth. The machines are 19 ft. high from the base to the top of the terminals, and the tanks are 9 ft. high and 9 ft. in diameter. One high-tension terminal of each transformer is earthed to the core and case, the other being brought out.

THE EXAMINATIONS OF THE I.E.E.

THE first examination for candidates for the Associate Membership of the Institution of Electrical Engineers was held in May last, and the June issue of the *Journal* of the Institution contained a list of the successful candidates, together with the names of the examiners and the subjects for which they were severally responsible.

We do not propose to consider in detail the papers which were set at this examination, or to discuss the results; there are, however, certain broad aspects of the scheme of examinations which we think may be considered with advantage at the present time.

We feel that the action of the Council in instituting these examinations as a test of the general education and of the scientific and technical training of candidates for entry to the rank of Associate Membership is a wise one, and that it is in consonance with the object for which the Institution was founded in 1871, namely:—"To promote the general advancement of electrical and telegraphic science and its applications." There can be little doubt that the ultimate result of the action of the Council in this matter will be to raise the professional status of the Institution, and enable it to influence beneficially the courses provided by the schools and colleges in the country for the training of electrical engineers.

With a view to ascertaining whether the influence of the examination in its present form is altogether in the direction of advancement, we shall proceed to consider the scheme in some detail in the following connections:—

(*a*) The relation of the examination to existing curricula in electrical engineering in day and evening schools.

(*b*) The qualifications for exemption from the examination.

(*c*) The suitability of the examination as a test of training and attainment.

As a preliminary, it may be well to state briefly the subjects of the examination.

The examination is in two parts; the first part consists of an English essay, or translation into English of passages in one of the following languages, to be selected by the candidate:—French, German, Italian or Spanish. In addition to this, a composite paper in Science must be taken, in which the section on Applied Mechanics is obligatory, while the sections on Physics and Chemistry are alternative.

The second part of the examination consists of two papers on one of the following subjects, to be selected by the candidate:—(*a*) Electricity Supply (generation, transmission and distribution); (*b*) Electric Lighting and Power; (*c*) Electric Traction; (*d*) Telegraphy; (*e*) Telephony; (*f*) Application of Electricity in Mines; (*g*) Electro-Chemistry and Electro-Metallurgy; (*h*) Manufacture of Electric Machinery (including works management); (*i*) Design of Electric Machinery and Apparatus.

The papers in Part II include optional questions in administrative and economic matters. No detailed syllabus of the subjects of examination is published.

(*a*) *The Relation of the Examination to Existing Curricula in Day and Evening Schools.*

The examinations will not affect the courses for engineering degrees in any University in the United Kingdom or in the British Dominions, or for the certificates and diplomas in electrical engineering issued by six schools and colleges in London, three colleges in the North of England, two colleges in Scotland and one Colonial college. The certificates of these colleges are accepted by the I.E.E. as exempting candidates from the whole of the examination.

The number of approved colleges might be extended with advantage, since the geographical distribution of the colleges approved at the present time leaves considerable sections of England (*e.g.*, the Midlands and the South of England) without adequate provision.

So far as day courses are concerned, candidates for the examination will be drawn from students who have not been successful in obtaining degrees or diplomas which exempt from the examination, or who have taken taken day courses at schools or colleges which are not recognised by the I.E.E. as exempting from the examination.

A typical day course in electrical engineering would extend over three years, and would consist in the first year of instruction in mathematics, mechanics, physics, chemistry, and engineering drawing. The second and third year courses would comprise instruction in mathematics, engineering drawing and designing, strength of materials, heat engines, hydraulics, electrotechnics, electricity supply, electric traction, and electrical design.

Part I of the I.E.E. examination would be covered by the work done by a student for the entrance examination to the college, and in the first year of his college course.

Part II of the examination is concerned entirely with the technical applications of electricity; only one branch of the subject may be selected by a candidate, and since two papers are set in each branch, it is evident that a considerable degree of specialised knowledge is called for.

It is eminently desirable that schools and colleges should not attempt to specialise to the extent called for by Part II of the examination. Their function should be to give a broad training in the principles of mechanical and electrical engineering. Students who are not attending courses recognised for exemption will desire to sit for the I.E.E. examination at the end of their school course. If the schools yield to this desire on the part of the students, it will necessitate a large amount of informational training being given at the expense of educational training, and it will result also in the elimination of most of the teaching in mechanical engineering subjects in the second and third year courses, and in a premature and unreal specialisation in electrical subjects.

It may be urged that these students should pursue the curriculum at present laid down for them in their day courses, and that on the completion of their day training they should continue their studies in evening classes with a view to specialising before sitting for the I.E.E. examination.

In the circumstances, this probably would be the best course to pursue, but it would lead undoubtedly to "cramming" in the evening classes, and it is open to the further objections that the work done for Part I of the examination would be separated from the date of the examination by an interval of four or five years, while the work for Part II of the examination would have to be carried on under the adverse conditions which are inseparable from evening instruction.

Candidates for the examination will also be forthcoming from the ranks of those whose technical education has been obtained wholly or in large part in evening classes, and it will be well to see to what extent the I.E.E. examinations may influence the curricula of such students.

In this connection we shall have to reckon with a strong educational movement which aims (in all except the final years of the courses) at breadth of training rather than specialisation and at instruction in principles rather than in details of current practice. This movement, which had its inception in the North of England about 10 years ago, has now spread over the whole country. Its characteristic feature is that a technical subject, such as electrical engineering, is not taught as a single subject, but that concurrent instruction is given in branches of science and technology which are akin to it. For this reason it is known commonly as the "grouped-course system." As a rule, the instruction extends over 2-2½ hours on each of three evenings a week for four years, with a further year which is devoted to specialisation. A typical group-course of training in electrical engineering would be somewhat as follows:—

First Year.—Mathematics, mechanics and physics, engineering drawing.

Second Year.—Mathematics, technical electricity, engineering drawing.

Third Year.—Mathematics, elementary C.C. and A.C. work.

Fourth Year.—Mathematics, intermediate C.C. and A.C. work.

Fifth Year.—Advanced courses in specialised branches of mechanical and electrical engineering.

The time which an evening student can give to study is extremely limited, and the conditions under which he obtains

instruction are unfavourable. The solution of the difficult problem of evening instruction lies in the supersedence of evening classes by part-time day courses. Under present conditions, however, the specialisation called for in Part II of the examination will tend to foster study in single subjects, and to discourage the broader training which the grouped-course system involves.

The grouped-course system has only recently been established in the South of England, and its scheme of internal examinations with external assessors has not yet been developed fully. It is suggested that the Council should watch carefully the development of this system with a view to recognising the grouped-course certificates of approved institutions as exempting from the examination. This action on the part of the Council would tend to conserve in evening courses in electrical engineering, that breadth of curriculum and attention to principles which is so essential to a sound engineering training.

(*b*) *The Qualifications for Exemption from the Examination.*—In addition to the degrees in engineering of any British University, and to the diplomas and certificates of certain approved Institutions, the following qualifications are accepted as exempting from the whole of the examination:—Whitworth Scholarships, Commissions in the Royal Engineers, Royal Artillery and Royal Navy (Engineering branch), and the Final Grade Certificate of the Department of Technology of the City and Guilds of London Institute.

The presentation of a thesis, paper, or other approved contribution, on acceptance by the examiners, will exempt from the examination, but the candidate is liable to be examined upon his thesis, either orally or in writing, at the discretion of the examiners.

A science degree from any University in the United Kingdom or the British Dominions will exempt from Part I of the examination.

The Council will consider on its merits, with reference to exemption from the examination, any other engineering degree, diploma, or certificate of equivalent standing to those enumerated above, which may have been obtained by a candidate from any University or College in the United Kingdom or abroad.

It is not to be expected, or even to be desired, that precise identity of standard should obtain in these various qualifications for exemption, but it will be seen that the chief characteristic of nearly all of them is the fact that the candidate must have been *trained* specifically as an engineer. The exception to the above is the final certificate in Electrical Engineering, issued by the Department of Technology of the City and Guilds of London Institute. For this certificate there is no examination in General Education, in Mechanics, Physics, Chemistry, or in Mechanical Engineering subjects, but the certificate is obtained as the result of passing three examinations in electrical subjects only.

The presentation of a thesis or paper is an admirable alternative to the examination, and the Council is to be congratulated upon the stimulus that this provision is likely to give to research. There is no direct qualification in general education or scientific training involved other than is necessitated by the writing of the thesis, but if additional evidence of these qualifications should be necessary, it may be obtained by means of the oral or written examination to which the candidate may be required to submit himself at the discretion of the examiners.

(*c*) *The Suitability of the Examination as a Test of Training and Attainment.*—We have seen in connection with the qualifications for exemption from the examination that adequate training in engineering is necessary; we have seen also that the majority of students sitting for the examination will be composed of those whose training in day courses has been incomplete or unsuccessful, or whose technical training has been obtained under adverse conditions in evening classes.

In order, therefore, that the character of the examination should be comparable with that of the qualifications for exemption, it is necessary that the examination should furnish a reliable test of the engineering training of the candidates. It is at this point that the I.E.E. examination, in common with all other examinations which are purely external in character, breaks down.

Of all students, the engineering student lends himself least to a true appraisement of his training by means of external examinations, for it is quite impossible to test satisfactorily by this means the laboratory work and practical work upon which his training is based.

From the extremely short list of successes in the recent examination, it would appear that the Council is fully alive to the defects and limitations of a purely external examination.

It seems probable that the Council intends to make as little use as possible of the examinations, and to rely mainly upon its carefully selected set of exemptions as a means of entrance to the professional ranks of the Institution. In this we feel that the Council is acting wisely and in agreement with the best educational opinion of the day.

It is, however, desirable that some steps should be taken in connection with the examination to place emphasis upon the element of training. This could be effected by requiring from candidates, as a condition precedent to sitting for the examination, that they should produce a certificate showing that they had attended and worked satisfactorily either in a day course in electrical engineering or in grouped courses of approved character in the evening. Candidates who are not able to produce a certificate of this nature should be obliged to submit themselves to an oral examination in addition to the written test.

THE LATEST TYPE OF RENNERFELT FURNACE.

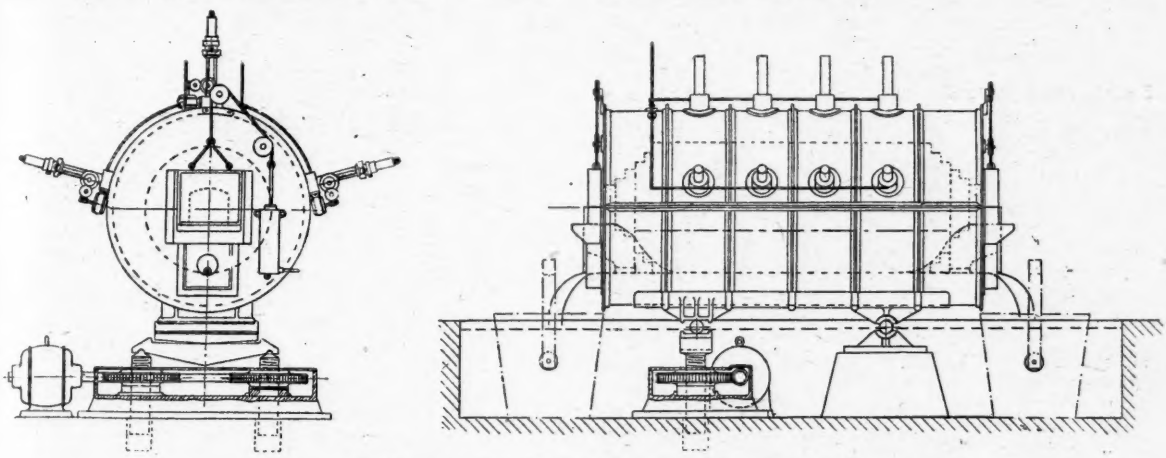
The original type of Rennerfelt furnace, developed in 1912, has already made itself prominent in the steel industries, particularly in Sweden, Norway and Russia. This furnace consisted essentially of a chamber lined with fire brick and an inner covering of basic or acid bricks in which three Acheson graphite electrodes, one vertical and two horizontal, converged to a point some six or twelve inches above the top surface of the material to be treated. The arc was sprayed downwards on to the surface by electromagnetic repulsion, and hence a very uniform operation was secured, materially assisted by heat reflected from the roof above the electrodes. The smooth running properties and efficient performance, together with high power factor and low cost per ton of material treated, place the furnace in a very favourable position.

Within recent times, however, the range of operation of the furnace has been extended. The furnaces with three electrodes only ranging from 100 kilogrammes up to, say, three tons capacity were particularly adapted for small crucible work, together with steel foundry, copper, alloy and chemical processes requiring high temperatures, but the restriction in size can be removed by adopting a multiple arc furnace based on the same principle, and we are indebted to the Aktiebolaget Elektriska Ugnar, of Stockholm, Sweden, for particulars of the latest advance in this direction, providing a really large electric furnace capable of receiving the entire charge of steel from the Bessemer converter or open-hearth furnace up to 50 or 75 tons in size. The refining furnace of 75 tons requires about 7,500 kilowatts, and to properly change this large amount of energy into heat in an effective manner is an engineering operation involving many important problems.

Obviously, it is imperative to sub-divide the energy of such a furnace into a number of smaller units by employing several sets of electrodes. Thus the size of each electrode can be kept within such dimensions as are practicable to manufacture, and furthermore, the generation of heat will not be concentrated in a few points where the temperature would be so excessive that no brickwork, either acid or basic, would be capable of enduring it, but is much more uni-

formly spread over the working area of the furnace. The Rennerfelt multiple arc furnace is illustrated in Figs. 1 and 2. It will be seen that the furnace is built as an elongated crucible preferably of cylindrical cross section, made up of a number of similar sections bolted to one another, and each fitted with one set of electrodes arranged according to the diagram Fig. 3. The small heat-generating sets of electrodes are thus distributed over the entire surface of the bath, which therefore is uniformly heated all over. The heat radiated from the arcs has only a short distance to pass to the steel, whereas the distance from the arcs to the roof and walls is considerably greater. In this way the furnace can be worked at a very much higher average temperature than can be carried in such a large furnace with only a few electrodes.

The wear and tear on the brickwork is correspondingly reduced and the output of the furnace is largely increased, and in this way there is a saving effected both in upkeep and renewals. More rapid and certain chemical reactions are also obtained



Figs. 1 and 2.—End and Side Elevations of the Rennerfelt Furnace.

through the better distribution of heat and the higher mean temperature existing in the active zones. The cylindrical elongated form of the furnace gives the advantage of a strong casing which is not subject to distortion by the heat. The furnace is constructed in rings utilising bricks of only a few simple patterns, and these can be set with a minimum of labour and without the necessity of injurious and expensive cutting.

The furnace can be lengthened by simply adding cylindrical sections to the shell; the cost of increasing the capacity of an existing furnace is therefore small. The control of the furnace is very simple, as the current is distributed between several sets of electrodes connected in parallel, but otherwise independent of each other. One may consider the entire plant as made up of several small furnaces each kept under separate and easy control. The electrodes, cooling boxes, switches and circuit-protecting apparatus are thus simplified and cheapened. Irregularities in the consumption of energy become less troublesome and disturbing, and occur in arcs of comparatively small size, and hence the power curve of a furnace thus heated approaches a straight line with only a few relatively unimportant deviations.

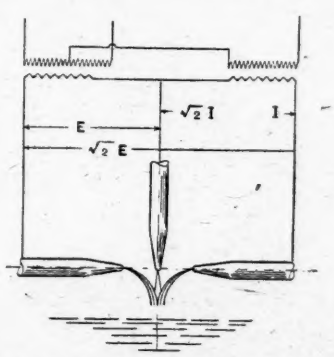


Fig. 3.—Diagram of Connections.

The 15-ton multiple arc furnace uses about 1,800 kilowatts, and has eight arcs of 225 kilowatts each. The current in each electrode is 2,500 amperes. The problem of automatic control of the electrodes has been solved in a very simple manner. Only the horizontal electrodes need control, and as these are of small size only a small force is required to adjust them so that each receives its normal current. Once the multiple arc furnace has been started and adjusted to normal conditions, the regulating machinery for the horizontal electrodes works in the same way as the corresponding device in the familiar arc lamp, provided that the furnace is used for refining liquid material only.

Any kind of electric current, alternating or direct, can be used, and the frequency of alternating current is of little importance. The construction of the brickwork is simple, strong and durable, with a minimum loss of heat from radiation. The roof of the furnace is not weakened by more than one small electrode in each section. On account of its form, the roof may be made of brick, permitting working with a very high average temperature. Those portions of the brickwork most exposed to destruction can be quickly repaired without dismantling the furnace. The fettling of the melting chamber may be thoroughly and rapidly sintered without introducing coke or other fuel under the electrodes; hence the maintenance is simple, giving a long life to the lining. The thermal efficiency is high, because of the peculiar method of generating the heat, the interior being sealed to prevent the outside air from entering. The heat emitted by the arcs spreads uniformly over the whole surface of the charge, the shape and position of the arcs relative to the slag increasing the chemical activity between steel and slag. The electrodes are placed rather high above the surface of the slag, and are thus well protected from the strongly oxidising slag during the period of dephosphorisation. Owing to the position of the electrodes above the charge, the furnaces can be tilted without shutting off the power or withdrawing the electrodes. The regulation of the power is simple, only two of the three electrodes belonging to a three-phase furnace having to be attended to. The operation of the furnace is quiet and smooth, even if the bath is boiling violently. The consumption of the electrodes is small. The phase displacement is also small, cos ϕ varying between 0.9 and unity, and non-ferrous alloys can be melted without

being evaporated by too high a temperature, as the arcs are not in contact with the charge. On all these counts, therefore, the furnace is of an interesting and useful description.

IMPORT TRADE STATISTICS OF SWITZERLAND.

THE following figures of the imports of electrical and similar goods into Switzerland in the year 1912 are taken from the recently issued official trade statistics; the figures for 1911 are added for purposes of comparison, and notes of increases or decreases are given. Attention should be called particularly to the predominant position of German trade as contrasted with the practically insignificant British share in most lines :—

	1911. Francs.	1912. Francs.	Inc. or dec. Francs.
Electric cable not insulated.—			
From Germany	28,000	37,000	+ 9,000
,, France	19,000	3,000	− 16,000
,, Other countries ...	—	1,000	+ 1,000
Total ...	47,000	41,000	− 6,000
Electric cable insulated with rubber or paper.—			
From Germany	90,000	145,000	+ 55,000
,, Great Britain ...	5,000	5,000	—
,, Other countries ...	14,000	19,000	+ 5,000
Total ...	109,000	169,000	+ 60,000
Cable ditto covered with lead.—			
From Austria	43,000	68,000	+ 25,000
,, Germany	2,000	2,000	—
Total ...	45,000	70,000	+ 25,000
Cable insulated with rubber or paper and covered with textiles.—			
From Germany	192,000	314,000	+ 122,000
,, Other countries ...	18,000	15,000	− 3,000
Total ...	210,000	329,000	+ 119,000
Cable ditto covered with lead.—			
From Germany	95,000	32,000	− 63,000
,, Austria	—	57,000	+ 57,000
,, Other countries ...	5,000	2,000	− 3,000
Total ...	100,000	91,000	− 9,000
Steam boilers of iron or steel.—			
From Germany	1,995,000	2,624,000	+ 629,000
,, France	177,000	226,000	+ 49,000
,, Belgium	24,000	10,000	− 14,000
,, Great Britain ...	31,000	25,000	− 6,000
,, Other countries ...	22,000	45,000	+ 23,000
Total ...	2,249,000	2,930,000	+ 681,000
Dynamo-electric machines and electric transformers.—			
From Germany	921,000	1,361,000	+ 440,000
,, France	38,000	45,000	+ 7,000
,, Italy	23,000	38,000	+ 15,000
,, Great Britain ...	3,000	16,000	+ 13,000
,, Other countries ...	32,000	19,000	− 13,000
Total ...	1,017,000	1,479,000	+ 462,000
Hydraulic and wind motors and pumps.—			
From Germany	679,000	727,000	+ 48,000
,, Austria	40,000	13,000	− 27,000
,, France	32,000	43,000	+ 11,000
,, Italy	35,000	28,000	− 7,000
,, Great Britain ...	4,000	14,000	+ 10,000
,, United States ...	20,000	16,000	− 4,000
,, Other countries ...	10,000	7,000	− 3,000
Total ...	820,000	848,000	+ 28,000
Steam engines, locomobiles, steam turbines, etc.—			
From Germany	228,000	437,000	+ 209,000
,, France	10,000	41,000	+ 31,000
,, Great Britain ...	55,000	71,000	+ 16,000
,, Other countries ...	7,000	6,000	− 1,000
Total ...	300,000	555,000	+ 255,000
Gas, petrol, benzine, etc., motors.—			
From Germany	192,000	306,000	+ 114,000
,, France	180,000	123,000	− 57,000
,, Italy	13,000	36,000	+ 23,000
,, Great Britain ...	17,000	11,000	− 6,000
,, United States ...	50,000	35,000	− 15,000
,, Other countries ...	15,000	20,000	+ 5,000
Total ...	467,000	531,000	+ 64,000
Accumulators, batteries, electrodes.—			
From Germany	196,000	244,000	+ 48,000
,, Austria	48,000	77,000	+ 29,000
,, France	37,000	31,000	− 6,000
,, Other countries ...	16,000	8,000	− 8,000
Total ...	297,000	360,000	+ 63,000
Insulators, mounted.—			
From Germany	60,000	93,000	+ 33,000
,, France	3,000	2,000	− 1,000
,, Other countries ...	2,000	3,000	+ 1,000
Total ...	65,000	98,000	+ 33,000
Electric meters.—			
From Germany	1,108,000	970,000	− 138,000
,, France	67,000	104,000	+ 37,000
,, Italy	21,000	10,000	− 11,000
,, Great Britain ...	10,000	3,000	− 7,000
,, United States ...	14,000	5,000	− 9,000
,, Other countries ...	20,000	17,000	− 3,000
Total ...	1,240,000	1,109,000	− 131,000
Telegraph and telephone apparatus.—			
From Germany	300,000	348,000	+ 48,000
,, Belgium	165,000	297,000	+ 132,000
,, Great Britain ...	68,000	19,000	− 49,000
,, Sweden	20,000	44,000	+ 24,000
,, Other countries ...	36,000	16,000	− 20,000
Total ...	589,000	724,000	+ 135,000

NOTE.—25 francs = £1.

GERMAN RULES FOR ELECTRICAL INSTALLATIONS.

THE outstanding feature of the revised rules proposed by the V.D.E. for application to the erection and operation of light and power installations lies in the inclusion of clauses minimising the danger to which operators are exposed, by requiring liberal clearances between and insulation of accessible live parts; discouraging the use of inaccessible connections; and requiring the provision of indicating plates and devices (specifying the nature of current carried by apparatus and showing whether the latter is live) and improved permanent or emergency earthing arrangements. Space limitations forbid a complete review of the new rules, but in the following paragraphs are summarised a few of the more important and particular new clauses; those of more general application, which are covered by the above indication of scope, are perforce omitted from further mention.*

Throughout, the rules are intended to secure that live parts in general and high-tension parts in particular may be inaccessible when possible to workers and others, and that when such parts are necessarily accessible they may be adequately insulated or screened. Great emphasis is laid upon the desirability of admitting only thoroughly reliable and competent men to high-tension enclosures and test rooms, etc., of instructing these men in the risks to which they are exposed and the precautions which they should observe, and of providing adequate inter-locking devices, pilot lamps and other safeguards, including warning tablets and distinctive markings, in and on high-tension enclosures, apparatus and the switchgear controlling supply thereto. Stress is laid upon the importance of earthing thoroughly all metal parts which cannot be insulated but which may become live.

Lacquering or enamelling is not to be taken as sufficient insulation to protect against shock. High-tension insulating materials must be damp-proof if solid, and suitably impregnated if of fibrous or porous material. In low-voltage networks, the leakage current between any two fuses or behind the last fuse must not exceed one milliampere under working pressure, *i.e.*, the insulation resistance of each line section and distribution board must be at least 1,000 ohms per 1-volt working pressure.

Bare H.T. lines must be separated from other lines, walls or

* A complete draft of the new rules is to be found in the *E.T.Z.*, pp. 46-50; 71-76: 1914.

protective coverings by the following minimum distances:—Up to 1,000 v., 2in.; 3,000 v., 3in.; 6,000 v., 4 in.; 12,000 v., 5 in.; 24,000 v., 7 in.; 35,000 v., 9½ in. The voltage refers to that between lines in the circuit concerned. Outside buildings, H.T. lines must clear walls by at least 1 CM. (.4 in.) per 1,000 v. with a minimum of 4 in. Insulated conductors for pressures exceeding 1,000 v. must be spaced at the distances stipulated for bare wires if they are laid on bells, rollers, etc., without protection of their insulation against weathering; below 1,000 v., 2 CM. spacing is sufficient.

Overhead high-tension lines must be bare except for suitable painting where corrosion is to be prevented. In buildings, bare H.T. wires are admissible only at contact lines (outside electric power houses and battery rooms) and must be fitted with isolating switches. Iron or reinforced concrete masts and anchor wires must be earthed and earthed line-guard rings or nets must be provided under specified conditions.

New rules applying to accumulator batteries prescribe that cells be insulated from their stands and the latter from earth by non-hygroscopic supports. It must be impossible to touch live parts at more than 250 v. P.D. during attendance on the cells. Insulated footplates must be provided round high-tension batteries, and it is recommended that batteries working at 1,000 v. or higher pressure above earth be divided by section switches into 500 v. groups. Celluloid may not be used for battery cases or outside the electrolyte in cells for higher pressures than 16 v.

The minimum distance between walls and bare live parts on switchboards, etc., is fixed at 3½ ft. in low-voltage and 5 ft. in high-tension installations. If such parts are at a normally accessible height on both sides of a gangway, they should be at least 6½ ft. apart horizontally. High-tension parts in gangways should be specially protected if within 8½ ft. from the ground. Special rules apply to the making and safeguarding of connections on boards to which there is no back access.

Pressures exceeding 250 v. are not permissible in hand apparatus of 0.5 KW. or smaller capacity. Handles should be of insulating material where possible, and if controlling higher pressure than 1,000 volts, a permanently earthed link should be provided between handle and apparatus. Leakage currents over insulators must be earthed.

High-tension oil switches in circuits liable to 5,000 amps. or heavier short-circuit currents must be placed behind a wall protecting attendants from possible flame and burning oil. Current-carrying parts in starters and rheostats must be protected by fireproof material, mounted on fireproof supports and located away from inflammable material; this rule does not apply absolutely to electric power houses and sub-stations, etc. Plugs must be designed so that they cannot be inserted in circuits carrying higher current and voltage than those for which the plugs are designed; in high-tension circuits, it must be impossible to make or break plug or other temporary connections while either part is live.

Conductors must be of adequate mechanical strength and insulated copper wires and cords are rated as follows (abstract):—

Section. Sq. mm.	Current. Amps.	Corresponding nominal rating for fuses. Amps.
0.5	7.5	6
1.0	11	6
10	43	35
50	160	125
500	760	600
1,000	1,250	1,000

Bare copper wires up to 50 sq. mm. are subject to the same rating; larger wires and all overhead wires are subject merely to the stipulation of reasonable temperature rise. The smallest permissible copper conductor sections are:—Wires to and in lighting fittings, 0.5 sq. mm.; pendant cords, 0.75 sq. mm.; insulated wires laid in pipes or on insulators not more than 3½ft. apart or for portable use, 1.0 sq. mm.; insulated or bare wires in buildings or open for which points of suspension are more than 3½ ft. apart, 4 sq. mm.; overhead lines, 10 sq. mm. Fuses of soft, plastic metals and alloys must be provided with contact lugs of copper or other suitable metal. Multiple fuses and repaired plug fuses are not sanctioned.

In high-tension circuits, accessible glow lamps and fittings are permissible only for direct current and for pressures up to 1,000 volts. High-tension leads may not be used to suspend arc lamps and in such cases the lamp must be insulated from the insulating wire or chain and the latter from its support (if of metal) or both rope and carrier may be earthed; if the circuit pressure exceeds 1,000 v., both safeguards must be provided. Further, such arc lamps must be inaccessible during working and their circuits must include isolating switches. The clear diameter of tubes or cavities through which two leads are to pass in lamp fittings must be at least ¼ in. in low-voltage and ½ in. in high-voltage apparatus. Pipes laid under plaster must have at least 0.45 in. internal diameter (0.65 in. in H.T. circuits) if intended to accommodate more than one wire. Pendant fittings and hand lamps are inadmissible in high-tension circuits.

Others of the new rules apply to special provisions and exemptions to be made and precautions to be observed in special situations and installations, among which are electric power houses, accumulator rooms, damp situations, chemical works, places where explosion risks are present, shop windows, warehouses, testing laboratories, theatres and other public buildings.

The rules for the operation of heavy current installations are similarly arranged and demand little more than those provisions and precautions which ordinary experience and practice show to be desirable and which, in the absence of definite regulations, are so apt to be neglected from time to time. Finally, there is presented a most convenient and useful collection of signs and symbols to be used in denoting various circuits, instruments and apparatus. Nothing less than complete reproduction of this scheme would be of service, but the latter certainly deserves to be better known. A fundamental convention greatly simplifying complex wiring diagrams is the use of single lines to represent two or three-wire circuits, the actual number of conductors being indicated by double or treble dots on the apparatus diagrams and double or treble cross lines on the single conductor-lines, regulating switch handles and so forth. The German original is well worth the careful study of all interested.

ELECTRICAL WORK AT THE NATIONAL PHYSICAL LABORATORY DURING 1913.

A LARGE number of absolute measurements of resistance were made during 1913 with the Lorenz apparatus in the Physics Department of the National Physical Laboratory. The following table summarises the results obtained from resistances nominally of 0.001, 0.002 and 0.01 ohms:—

Lorenz coils used.	Nominal value.	Resistance. Absolute measure cm./sec.	International ohms.	Difference. Parts in 100,000 (Abs.-Int. × 10^9).
1, 2, 3, 4	0·001 ohm.	100091_6	$100039_8 \times 10^9$	$52'_8$
,,	0·01 ,,	100090_{10}	$100038_8 \times 10_9$	$51'_8$
,,	0·002 ,,	Standard varied slightly		53_1
1, 2	0·001 ,,	100090_4	$100039_8 \times 10_9$	$51'_1$
3, 4	0·001 ,,	100091_8	$100039_8 \times 10_9$	$52'_5$
				Mean = $52'_2$

A resistance of one International ohm is therefore 1.00052 ohms (10^9 cm./sec.); the probable error in the value 1.00052 is about four parts in 100,000. The length of the mercury column at 0°C. which has a resistance of one ohm is 106.245 ± 0.004 cm., the cross section being the same as that of a mercury column 106.3 long having a resistance of one International ohm. The whole Lorenz apparatus is in a very satisfactory condition.

In some of the absolute measurements of current made during the year the current was maintained constant and its value calculated from the weights used to maintain equilibrium in the current-weigher. In other measurements the current was allowed to vary, its mean value being calculated from the change in period of the balance. Current circulated in the coils so as to produce large increase or decrease in the restoring force but no change in the equilibrium position. This way of using a current weigher adds to the value of the instrument since direct determination of the electro-chemical equivalent of a substance may be made without maintaining a constant current.

Eight hermetically-sealed 1 ohm manganin coils were dispatched in July, 1913, to the Laboratoire Central d'Electricité, the Physikalisch-Technische Reichsanstalt, the Bureau of Weights and Measures (St. Petersburg) and the Bureau of Standards (Washington) for comparison with the resistance standards of these institutions. P.-T.R. values were 19 and 16 parts in 1,000,000 less than the N.P.L. values; the Bureau of Standards values were 7 parts in 1,000,000 greater; and the St. Petersburg values were 3 and 7 parts in 1,000,000 greater than the N.P.L. values. French mercury standards are not yet complete, but the standards maintained at the L.C.d'E. are known to agree with N.P.L. standards within 1 part in 100,000. Resistance measurements may therefore be regarded as being on the same basis the world over.

In 1911 Dr. Schuster suggested a new type of magnetometer by which any horizontal component of the earth's field could be compared with the field produced at a certain point by current flowing through coils of known dimensions. Preliminary experiments indicate that values of H can be measured with a probable error not exceeding 1 part in 100,000 of the C.G.S. unit, the time necessary for a measurement being about four minutes. A precision instrument will be built in the Laboratory workshops.

Present magnetic disturbances due to electric tramcars can be coped with, but any additional disturbance may greatly increase the difficulty of making precise electrical and magnetic measurements. Two recording instruments have been erected in a non-magnetic hut to measure changes in the horizontal component of the earth's field and in the declination. Records show that the present sudden variations in H are of the order of $5\,\gamma$; very sudden changes in declination (exceeding $2'$ of arc) have not been observed.

The equilibrium of the Weston normal cell has been studied to obtain a satisfactory explanation of the hysteresis phenomena first mentioned in the 1911 B.A. Report. Investigation of the hydrolysis of mercury sulphate has confirmed the work of

Gouy and shows that hydrolysis can be prevented by adding 1 part of sulphuric acid to 10,000 of water. A new method has been used to determine the solubility of mercurous sulphate solution in water and in cadmium sulphate solutions. Mercurous sulphate solution is contained in one limb of a cell, the E.M.F. of which is measured as titration proceeds. When mercury ions practically vanish from the solution there is a sudden change in the E.M.F. of the cell. By plotting E.M.F. against volume of titrating liquid, the amount required for complete precipitation of mercury is obtained.

Experiments on dielectric losses in condensers have now been extended to frequencies (at least 1,000,000 cycles) covering the range which has so much practical importance in wireless telegraphy. With well-dried castor oil as dielectric, the power factor is 0.0005 at 800 cycles but 0.038 at 1,000,000 cycles per second, and this increase in the power losses at high frequencies makes castor oil unsuitable for condensers to be used in wireless telegraphy, particularly as the oil has a high temperature coefficient (about − 0.3 per cent. per 1°C.). Well-dried petroleum behaves well as regards temperature coefficient and high-frequency dielectric loss. Mica condensers are also very good, but their temperature coefficient, though small, is much greater at 25°C. than at 10°C.

Three mutual inductometers have been constructed, the range of inductance measurement now running from 10^{-9} henry up to over 1,000 henries. Moving coil vibration galvanometers have been constructed with unifilar torsional control and coils of low effective resistance. Combination of the latter with high sensitivity gives increased accuracy in measuring small inductances such as occur in small coils and single loops used in radiotelegraphy. The constants of more than 350 wavemeter coils were evaluated at a number of different frequencies; in a few cases, instruments were tested up to 6,000 metres wave length.

Much work was done in decrement and high-frequency resistance measurements. The determination of radiotelegraphic efficiency depends largely on decrement measurements. The high-frequency effective resistances of coils with solid and stranded wire were determined by direct power measurements; the results corroborated Lindemann's discovery that, at certain frequencies, solid are better than stranded conductors. Further experiments are in progress.

Commercial frequency meters have been calibrated from 300 up to 800 cycles per second by aid of a Duddell singing arc and standard tuning forks.

Photometric investigations indicate that new values for the laboratory electric sub-standard lamps (in terms of the pentane lamp) will agree very closely with the determination made ten years ago. The reliability of the later sub-standards (1.5 watts per mean horizontal candle) has been fairly well demonstrated. An accuracy of 0.25 per cent. can be ascribed to the international intercomparison of high-efficiency light standards, the final value ratios being :—Reichsanstalt/ (N.P.L. × 0.9) = 1.00 ; Bureau of Standards/N.P.L. = 0.99 ; Laboratoire Central/N.P.L. = 0.99 .

At the request of the Local Government Board, an investigation has been undertaken to see if anything can be done to mitigate the nuisance of dazzle produced by motor car headlights. It being impracticable to reduce the general intensity of the beam, experiments have been made with acetylene and electric headlamps adapted to produce beams in which the upper right hand portion (as seen from behind the lamp) is blotted out. This leaves the driver with light to the full height on his left hand side and below the horizontal for the full width of the road. Provided such lamps are mounted correctly, they are satisfactory to the driver and of marked advantage to on-coming traffic. Unless fitted with louvres, parabolic lamps are not so easy to deal with as those constructed on the lens-mirror principle.

An account of work undertaken for the Departmental Committee on Industrial Lighting will be embodied in the Committee's Report. The bureau of the International Illumination Commission is at the Laboratory, Mr. Paterson being Hon. Secretary. An investigation which promises to lead to interesting and useful results is one on the constants of diffusing surfaces and media and methods of measuring them. Knowing these constants, it is possible to determine the coefficient of reflection of materials by direct measurement of surface brightness using illumination photometers.

An apparatus has been built and used successfully to spin large sources of light and facilitate the measurement of their curves of mean candle-power distribution. Arc lamps must be rotated slowly, but 3,000 C.P. nitrogen lamps may be rotated as rapidly as desired.

The testing of A.C. wattmeters and watt-hour meters has been an important and growing part of the work of the Electrotechnics Department. Many of the instruments being for use in official tests, the disposal of bonus and penalty sums depended on the results of such calibrations. The apparatus described by Paterson, Rayner and Kinnes (I.E.E., May, 1913) has been used practically to its full capacity and improvements in detail have been made to expedite testing.

A special switch designed for use in 20,000-volt circuits has been completed to permit watt and watt-hour meters to be tested with current and potential transformers complete (as used in practice). New 500-ampere and other 2,000-ampere water-tube resistances are being built to permit three-phase meter testing at higher currents than heretofore.

Heating tests on field coils have shown that impregnating coils of cotton-covered wire after winding, generally produces appreciable reduction of the internal temperature gradient. The use of a protective covering of tape or other material may be expected to increase the internal temperature by 15°C.

The capacity of the large battery used for heavy-current D.C. testing has fallen to about 70 per cent. of the original capacity, due to deterioration of the negative plates. The positive plates are expected to last for some years longer.

The insulation resistance of the ebonite tops of the large resistance bridge and standard coils (used for commercial tests) has deteriorated badly. The coils have therefore been remounted in oil-filled hermetically-sealed brass cases; connection is made to mercury cups as well as to terminals. The present plug contacts in the bridge are to be replaced by dial switches mounted on ebonite and protected by a metal cover.

The resistance of steel conductor rails is usually specified in terms of copper, comparison being made sometimes between rails of equal length and weight, sometimes between rails of equal length and section. Steel rails are invariably bought by their weight per yard and it is hoped, in co-operation with the Engineering Standards Committee, to arrive at a specification permitting ready comparisons of conductivity of rails of different weight, resistance being measured and quoted in ohms or microhms. Tables of conversion and correction factors have been prepared connecting values obtained by the old and new methods. Resistance measurements and chemical analyses show that (in the samples tested) the resistance of steel rails varies in the same direction as, and the temperature coefficient in the opposite direction to, the total amount of impurities present.

The work in hand for the Wiring Rules Committee of the I.E.E. has made good progress during the year. A report has been presented concerning the heating of flex used with heating apparatus. Experiments relating to high temperature deterioration of standard cables show that slight difference in quality of the insulating material may lead to widely different results, hence the search will have to be extended to include all qualities of rubber, paper and oil used for insulating cables.

Arrangements have been made for investigations on the heating of buried cables to be carried out in eleven different towns, selected to include different sizes of cable and to cover practically all the systems of laying mains at present in use. Winter tests are to be made under normal load and summer tests with a special testing load. The scheme of tests to be made at these towns and the laying and testing of experimental mains at the Laboratory have been approved by the I.E.E., and it is hoped that experimental work will soon be commenced.

Last year's work on the emission of electricity from metals has been continued with a view to ascertaining to what extent the phenomena observed on a somewhat large scale with carbon can be reproduced with other substances. The metals employed were mostly in the form of strips 5 mm. wide × 50 mm. between clamps, the hot emitting area being about 4 sq. cm. Currents used to heat the strips varied from 50 to 250 amps, and the voltage from 0.5 to 5 volts. Iridium, platinum, iron, tantalum, nickel, copper and brass were tested, the strip being generally surrounded by nitrogen at reduced pressure. From the preliminary experiments conducted it appears that emission of positive electricity occurs at temperatures from 1,000° to 1,400°C. A sudden marked increase occurs at the liquefying points of metals melting within this range, probably due to sudden release of occluded gas. The positive emission is apparently augmented by presence of oxygen. At higher temperature, negative electricity predominates and increases rapidly with the temperature. The negative current attained with iridium at the melting point was 0.08 amp.; with tantalum at 1,670°C., 220 micro-amps.; and with iron at the melting point, 90 micro-amps. Probably these negative currents are a consequence of some reaction between the metal and surrounding gas. These results, in which currents were obtained without the usual applied potential, have a bearing on the question of electron emission from metals at high temperature. During experiments on the electrical emissivity of alkaline earths and other materials, when raised suddenly to the high temperature (2,000-2,500°C.) possible in a carbon resistance furnace, very large ionisation currents were obtained.

At the request of the Geodetic Survey of India, an apparatus has been designed to measure air temperatures within 0.1°C. at intervals of 15 ft. up to 150 ft. above ground (thus making possible approximate correction for air refraction in geodetic survey work). Ten appropriately spaced platinum resistance thermometers are connected by manganin wires in series with each other and with a standard manganin resistance. Potential leads are taken from the ends of each thermometer to a selector key and portable potentiometer. The potential drop over the constant resistance and the drop over each thermometer make possible easy determination of the temperature of the latter. Arrangements are made for screening the thermometers from solar and terrestrial radiation by double screens of aluminium painted balloon fabric which permit free air circulation to the wires.

It is expected that the revised specification for bayonet lamp holders will soon be issued. A series of "Not-go" cylindrical gauges (not included in the provisional draft specification) is considered necessary for the screwed part of the holder.

Measurements on 13 sparking plugs and four sets of taps show diametral dimensions about 0.2 mm. smaller than those given in E.S.C. Report No. 45. Measurements on the hexagons, barrel, etc., of the plugs have been tabulated.

The Laboratory Report includes a list of papers published by members of the staff and a summary of work proposed for the current year.

THE "POINT FIVE" ASSOCIATION.

At the meeting of this association at Birmingham, on June 18th, the chairman, Mr. Allen, of Wolverhampton, briefly reviewed the work accomplished by the members.

He asked were they aiding the manufacturers to decide upon what particular type of any piece of domestic apparatus was most suitable to the general body of users, and in what manner could they further the standardisation of apparatus, which must ultimately benefit them and the industry generally by cheapening the apparatus under consideration. It had been suggested that a central bureau might be established to test and report upon cooking, heating and other domestic apparatus. In his opinion the strongest bureau which could possibly be established was already in existence, and had for its working committee the members of the Point Five Association, because they were themselves handling such a large proportion of such apparatus. A central testing laboratory was far from satisfactory, and its staff was bound to get prejudiced opinions sooner or later. One of the most important things tending to set back progress in the general use of cooking and heating apparatus was the lack of the necessary power to hire out apparatus. Those undertakings which possessed powers had been able with a suitable tariff to increase their business enormously, with considerable advantage both to the consumer and to the electrical contractor. In Wolverhampton they had full powers. The tariff came into operation last autumn, and during the first six months the number of private house installations connected was three times as many as the number during the same period of the year previously, and they had supplied on hire just 500 kw. of heating and cooking apparatus. From other members he found that since the "point five" tariffs have been in vogue, connections for about 10,000 kw. had been made, and that about 7,000 kw. of cooking and heating apparatus had been connected up in private houses. The greater part of the cooking and heating apparatus comprising the 7,000 kw. was hired by the consumers, and were it not for the hiring facilities, the thousands of householders would never have been connected at all, much to the loss of the manufacturers, the supply undertakings, and to the wiring contractors who carried out more than three quarters of the necessary wiring work. There was a tariff question which would probably have to be considered by several members before long, and that was—How should electric car battery supply be charged to those domestic consumers now enjoying the "point five" tariff? He saw no reason why such a demand could not be treated separately on the differential system of charging with the units used charged at a halfpenny per unit. The fixed amount per annum would not be so easily determined as that due to a lighting supply.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Type Current Transformers.

Messrs. Vedovelli, Priestley & Co., Paris, whose agents are Messrs. Laing, Wharton, Ltd., 7, Great Newport Street, W.C., have recently brought out a type of current transformer, which is claimed to overcome all the troubles usually met with in this apparatus, and to combine with these properties high accuracy and

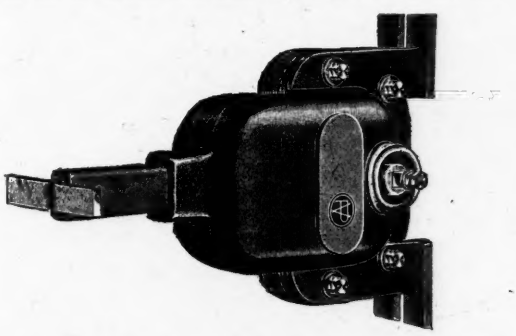


Fig. 1.—Coil Type Current Transformer.

low first cost. This type of transformer is shown in figs. 1 and 2, illustrating the coil type and straight-through bar type, suitable for slipping over bus-bars or cables where large currents are involved.

A feature of this transformer is that a special insulating material, with high insulation properties, is moulded under pressure round the windings and core of the transformer, thus forming both an electrical and mechanical clothing.

It is due to the high qualities of this material that such success has been obtained, these qualities being enumerated as follows :—

1 cm. thickness will withstand a pressure of 60,000 volts; it is extremely hard, and mechanically very strong, and begins to slightly soften internally at a temperature of 120° C. at the end of one hour.

It is non-hygroscopic, and the transformer can be immersed in water without damage to same.

It is impossible for the transformer windings to become displaced due to electro-magnetic forces caused by short-circuit, as the windings are embedded in the material moulded round them, and due to the thorough exclusion of air, no ozonisation and decay of the windings takes place.

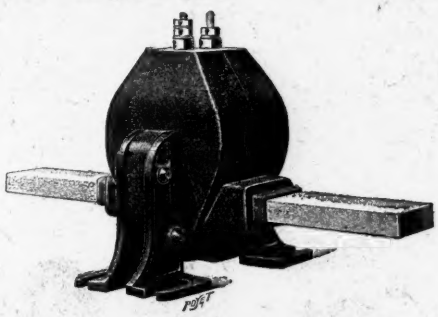


Fig. 2.—Bar Type Current Transformer.

The accuracy of the transformers is extremely high.

The transformers are made in four sizes, having capacities at 50 cycles of 20, 50 and 250 volt-amperes respectively.

Up to the present they have been constructed up to 5,000 volts pressure, and are now in the course of manufacture for a working pressure of 110,000 volts between phases and a test pressure of 250,000 volts.

In no single instance has a breakdown been experienced, although some transformers have now been in service for a period extending over four years.

Ironclad Switches and Adapters.

Messrs. G. F. Newnham & Co., of 7a, Shirley Road, Acock's Green, Birmingham, have just placed on the market a type of ironclad switch for conduit work, the design of which, we understand, is based on certain suggestions contained in our own columns.

The switch (shown in fig. 3) is constructed with a separate English china base to each pole, and a fire-proof division between them.

The case is of cast iron, stove enammelled black, fitted with an

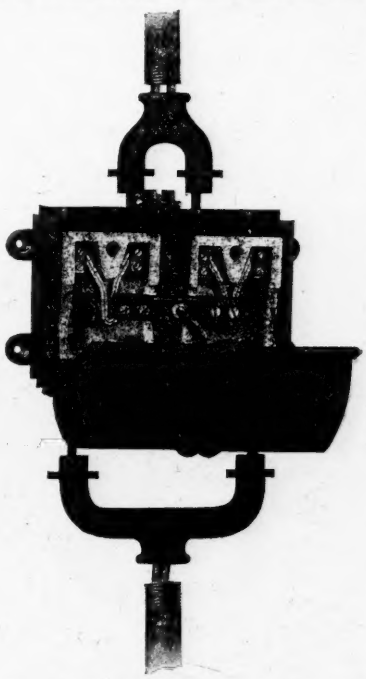


Fig. 3.—Ironclad Switch with Adapters.

earthing screw and provided with bosses, which can be tapped for conduit, either four holes at top or two each at top and bottom.

The switch cover is lined with insulating non-hygroscopic compound. Malleable iron black enamelled adapters are supplied to suit the switches, tapped and screwed for ¾ in. conduit.

The nipples are arranged to slip into clear holes drilled in the switch case and are held by screws, thus providing perfect continuity. The switches can be adapted for wooden bushes if desired, and are rated at up to 12 amperes and 600 volts.

The "Marvel" Cooker.

The Fireless Cooker Co., of Horton Street, Lyng, West Bromwich, send us particulars of their Marvel cooking outfit, which we illustrate in fig. 4. This includes an oven measuring 15 in.

× 9½ in. × 10½ in., an 8½ in. hot plate and a steamer with copper bottom to fit over it.

The oven is of sheet steel, well lagged, and provided with a movable rack and lined at the sides and back with aluminium. The heating elements are bolted to cast-iron detachable plates at top and bottom. The hot plate has two heat regulations and a small hot cupboard can be supplied to fit under it. A switchboard of polished teak with china switches, Zed fuses, and pilot lights is provided, with cable connections run in flexible metallic tubing to the heaters.

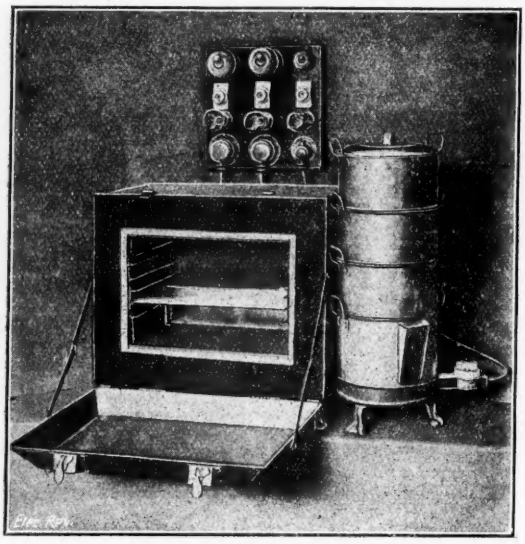


FIG. 4.—"MARVEL" COOKING OUTFIT.

Provision for earthing either by plugs, as shown in our view, or otherwise, is made. The outfit is claimed to be exceedingly economical in use, and is supplied in various sizes to suit usual requirements.

Ozone Generators.

Several new types of ozone generators have recently been designed by MR. C. W. DENNY, of 39, Oakley Crescent, Chelsea, S.W., and include apparatus for the purification of air and the sterilisation of water. Fig. 5 shows a portable fan ozoniser for the purification of air, and fig. 7 a small domestic type water steriliser, in section.

A novel feature in the design of this class of apparatus is the concentric tubular electrodes, which are shown mounted on a triangular spider in fig. 5. The inner tube has a specially prepared surface to facilitate the high-tension brush discharge; the air to be ozonised passes through an annular space between the two metal electrodes or tubes, which are in turn firmly mounted in conjunction with a micanite insulating tube.

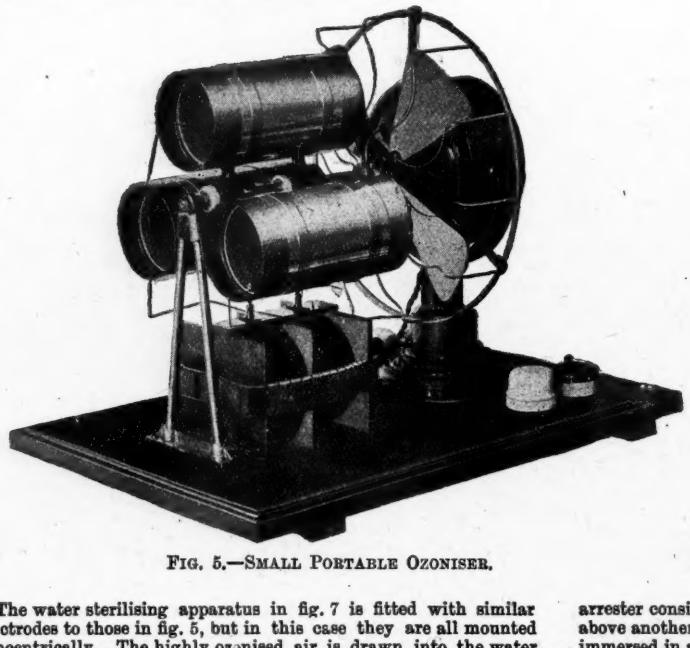


FIG. 5.—SMALL PORTABLE OZONISER.

The water sterilising apparatus in fig. 7 is fitted with similar electrodes to those in fig. 5, but in this case they are all mounted concentrically. The highly ozonised air is drawn into the water pipe on the injector principle and thoroughly mixed with the water in the mixing ball or chamber below. The water is then ready for consumption.

We understand that exhaustive tests on this class of ozoniser have been carried out by the Faraday House laboratories, which give very promising results, the concentration of ozone from one of the ozonising cylinders being as high as 71 parts per million; moreover, no nitrous oxides are produced.

Electric Candlestick.

We illustrate in fig. 6 a new and handy electric candlestick which is fitted with its own battery placed in the base. Access to the battery is provided by removing a metal footplate which is turned for opening by a key. The lamp is lighted by raising the handle and tightening the screw shown in the illustration. There is a hole in the handle so that the lamp may be fitted on a wall-hook. This candlestick fitting is a useful and inexpensive little novelty, and can be obtained from MESSRS. LIGHTING SUPPLIES, LTD., of 36, Commercial Road, London, E.

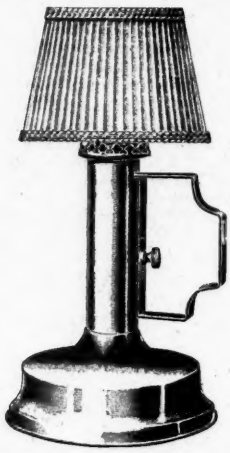


FIG. 6.—SELF-CONTAINED ELECTRIC CANDLESTICK.

B.T.H. Aluminium Lightning Arresters.

We have received from the BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, particulars of their latest aluminium lightning arresters, one of which is shown in cross-section in fig. 8. The arrester consists of a series of concentric inverted cones placed one above another, with the electrolyte between them, the whole being immersed in a tank of oil. The tank is of steel, with welded seams, and has a metal cover. An insulating cylinder surrounds the upper part of the stack of cones, and improves the circulation of the oil, while preventing failure of insulation between the cones

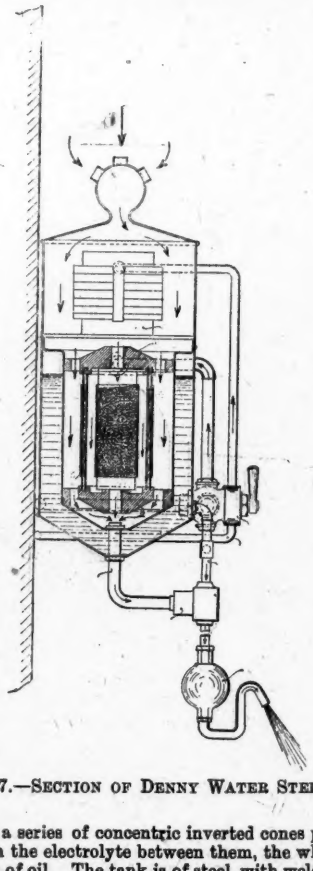


FIG. 7.—SECTION OF DENNY WATER STERILISER.

and the case. For a three-phase system four stacks are provided, connected together at the base; three are connected at the top to the lines through horn gap arresters, while the fourth is connected to earth, so that there are always two stacks in series between lines, and two between any line and earth. As the cells have to be "charged" for a few seconds daily, to renew the film of hydroxide

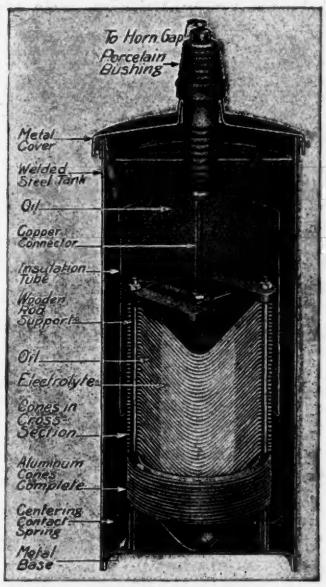


FIG. 8.—B.T.H. ALUMINIUM LIGHTNING ARRESTER.

on which their action depends, the horn gaps are modified to enable this to be done from the line with ease. Fig. 9 shows a standard horn gap for a 6,600-volt arrester, fitted with a charging resistance to limit the current, and a short-circuiting contact which can be actuated with safety. For higher voltages a rather more elaborate device is employed, having an auxiliary horn. Provision is also made for interchanging the earth stack with one of the line stacks during the charging operation, so that the films of all the

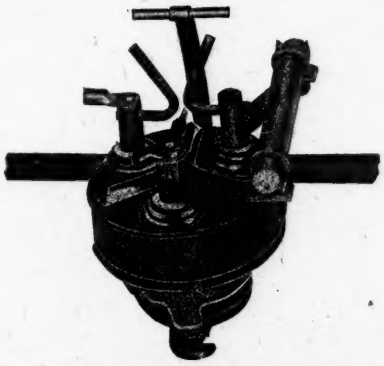


FIG. 9.—HORN GAP, WITH CHARGING RESISTANCE, &C.

cells can be formed up to the same value. No alteration is made in the setting of the horns during the charging operation, the present designs being an improvement on their forerunners in this respect. A special electrolyte is supplied for arresters that are used in climates where freezing has to be provided against.

Other devices used in conjunction with the arresters are charging-current indicators, which show the condition of the cells, and choke coils. These and other features of the B.T.H. arresters are described in List No. 4,505, recently issued.

Two New Vacuum Cleaners.

MESSRS. DUNCAN WATSON & CO., of 62, Berners Street, W., have recently introduced two new vacuum cleaners to the English market, known as the "Apex" and "Cleveland" respectively, and illustrated in figs. 10 and 11. The striking feature of these machines, which are excellently finished in every detail, is their low price—roughly two-thirds the cost of similar machines in use here.

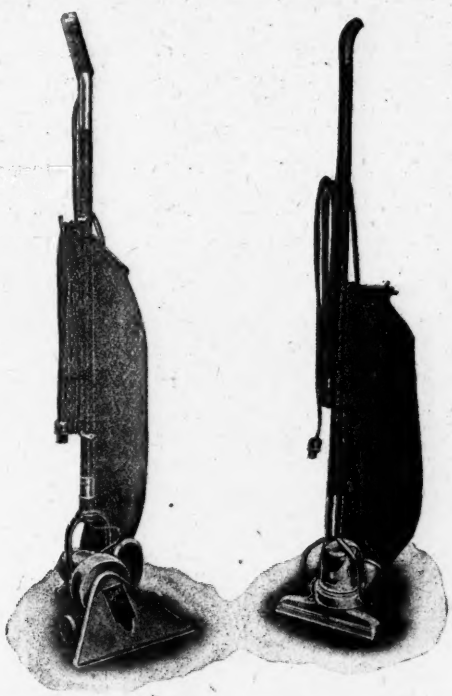
The Cleveland weighs about 9 lb. and is fitted with a small vertical motor, of universal type, suited for either A.C. or D.C., and fitted with bearings having oil reservoirs containing felt pads for holding the oil. A special Hart turn switch is contained in the handle.

A small rotary brush is fitted in the suction orifice to pick up fluff and cotton, and to use the various accessories, a special hose attachment can be plugged in either above or below the fan casing, providing either air blast or suction.

The Apex machine weighs about 1 lb. extra and costs rather more; it is fitted with a horizontal motor for either A.C. or D.C. and a divided splayed suction orifice, to which a small rotary brush attachment can be fixed.

Both machines run on small wheels, the Apex, however, has an adjustment to the back wheel which regulates the nearness of the suction nozzle to the floor.

In both machines the dust bag is provided with an inner tube to prevent the dust from falling back into the machine.



FIGS. 10 AND 11.—THE APEX AND CLEVELAND VACUUM CLEANERS.

Amongst the accessories, the length of suction hose has strong rubber connecting pieces at either end, and included are a solid steel handle, renovator, wall brush, &c. Either machine is rated at 100 watts and supplied with 18 ft. of flex.

The machines have been tested by Messrs. Duncan Watson against the numerous other standard types which they stock and certainly appear to lack nothing either in finish or performance by comparison with more expensive models.

"Universal" Electric Grill.

The accompanying illustration, fig. 12, shows the B. & K. "Universal" electric grill, introduced by the BROMPTON AND KENSINGTON ACCESSORIES CO., LTD., of 254, Earl's Court Road, S.W. It is adapted to a remarkably wide range of uses; it has a heating surface of 7⅞ in. × 4½ in., and it will boil, make toast

FIG. 12.—UNIVERSAL ELECTRIC GRILL.

grill bacon, chops, or a small steak, cook small portions of cereal, creamed chicken, beef, or potatoes, at the table. The heating element is close to the frame, thus securing the spread of heat over the entire surface. One pan has a depth of 2 in. and can be used above or below the heating element at the same time that some other dish is being prepared in one of the other pans. The base pans and frame are nickel-plated and highly polished, and the price is moderate.

Accident.—On Saturday, while testing a new electrical apparatus at the Goole Docks in a shed, a Manchester workman named O. Mosley was severely burned about the face and arms He got into contact with a "live" wire, and was taken to hospital in a precarious condition.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this Journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

15,506. "Recording mariners' compasses." R. KENNEDY. June 29th.

15,539. "Method of energy supply and control for wagons or trains of electric railways or similar contrivances by means of variable resistances." RIGHT HON. C. E. H. HOBHOUSE, W. SLINGO, H. C. GUNTON, W. H. POWELL, and J. R. KINGSTON. June 29th.

15,546. "Selecting-devices for telephone or other circuits." SIEMENS BROS. AND CO., LTD. June 29th. (Partly communicated by Siemens & Halske Akt. Ges., Germany). (Addition to 818/13). (Complete).

15,549. "Printing-telegraph apparatus." A. E. ALEXANDER. June 29th. (Union Switch & Signal Co., United States). (Complete).

15,550. "Printing-telegraph apparatus." A. E. ALEXANDER. June 29th. (Union Switch & Signal Co., United States). (Complete).

15,552. "Automatic fire-alarms." H. MARSDEN. June 29th. (Complete).

15,553. "Car switch-operating mechanisms." G. A. ERRINGTON. June 29th. (Complete).

15,560. "Systems or apparatus for the production and utilisation of electric currents." F. JUAN. June 29th.

15,576. "Magnetos." J. F. J. BETHENOD. June 29th. (Addition to 15,353/14. Convention date, October 4th, 1913, Belgium). (Complete).

15,580. "Connections for electric condensers." ALLGEMEINE ELEKTRICITATS GES., and H. ALAND. June 29th. (Convention date, June 28th, 1913, Germany). (Complete).

15,585. "Dynamo-electric machinery." HON. SIR C. A. PARSONS. June 29th. (Complete).

15,598. "Antiseptic protectors for telephones." T. LAMB. June 29th. (Complete).

15,602. "Electrolysis of metals." A. E. BATTLE. June 30th.

15,615. "Electric meters." BRITISH INSULATED & HELSBY CABLES, LTD., and L. B. WILSON. June 30th.

15,617. "Wire filaments for electric incandescent lamps and other electric resistances." W. H. SABINE. June 30th.

15,642. "Apparatus for the control or operation of railway and like points or switches." SIEMENS BROS. & Co., LTD. June 30th. (Siemens & Halske Akt. Ges., Germany). (Complete).

15,644. "Electric meters." H. ARON ELEKTRICITATSZAHLERFABRIK G.M.B.H. June 30th. (Convention date, December 22nd, 1913, Germany). (Complete).

15,676. "Electric ignition in internal-combustion engines." B. DORY, and E. BAJTAY. June 30th. (Complete).

15,681. "Apparatus for receiving or relaying electric signals." G. W. PIERCE. June 30th. (Convention date, August 5th, 1913, United States). (Complete).

15,690. "Electric couplings." J. BING. June 30th.

15,719. "Electric snuffer with protection against lightning and stray currents." A. G. DAVIES. July 1st.

15,727. "Intercommunication telephones." H. G. WHITE, and I. H. PARSONS. July 1st.

15,758. "High-tension electric ignition for internal-combustion engines." A. R. BELLAMY. July 1st.

15,767. "Means for elucidating electrical systems or circuits." A. A. CROFTS, and F. J. R. MACKENZIE. July 1st.

15,788. "Electrical vacuum discharge devices and methods of utilizing the same." BRITISH THOMSON-HOUSTON CO., LTD. July 1st. (General Electric Co., United States).

15,804. "Arc lamps." A. TRAFFORD, and C. E. HASELER. July 2nd.

15,843. "Electro-magnetic means for operating a movable member in a mechanism by a passing body." H. A. Cox, G. E. LLOYD, and H. E. OSBORNE. July 2nd.

15,857. "Wireless telegraphy." P. C. BIRD. July 2nd.

15,868. "Electric meters." BRITISH THOMSON-HOUSTON CO., LTD. July 2nd. (General Electric Co., United States).

15,870. "Pulsating-devices." A. G. BLOXAM. July 2nd. (W. R. Neiman, and H. Sorenson, United States). (Complete).

15,871. "Interrupting-devices for high-tension electric currents." SIEMENS BROS. & Co., LTD. July 2nd. (Siemens & Halske Akt. Ges., Germany). (Complete).

15,881. "Detector for electro-magnetic waves." DEUTSCHE TELEPHONWERKE G.M.B.H. July 2nd. (Convention date, January 24th, 1914, Germany). (Complete).

15,939. "Starting devices for electric motors." W. G. WILSON, and P. L. HARLOW. July 3rd.

15,946. "Junctions for overhead trolley wires." CEDES ELECTRIC TRACTION, LTD., and K. D. BOWEN. July 3rd.

15,958. "Windings of dynamo-electric machines." SIEMENS BROS. DYNAMO WORKS, LTD., and E. O. KIEFFER. July 3rd. (Complete).

15,967. "Electric lighting equipment of motor-car and like vehicles." G. A JELLY. July 3rd.

15,981. "Alarm Marconi-bell for ships in fog at sea and for railway train, air-craft, and the like." R. B. GUPTE. July 4th.

15,988. "Railway safe-running devices." A. R. ANGUS. July 4th.

16,007. "Incandescent electric lamps." W. W. D. KNIGHT, and H. E. CLERK. July 4th.

16,027. "Insulation of dynamo-electric machinery." MICANITE & INSULATORS CO., LTD., and J. ALLAN. July 4th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

9,090. RAILWAY SAFE-RUNNING DEVICES. A. R. Angus. April 17th. (April 17th, 1912).

9,109. APPARATUS FOR MINIMISING THE DESTRUCTIVE ACTION OF ELECTRIC ARCS, ESPECIALLY APPLICABLE TO ELECTRIC CUT-OUTS AND FUSES. V. Hope. April 18th.

11,214. DYNAMO-ELECTRIC MACHINES. V. A. Fynn. May 13th. (May 13th, 1912).

11,539. ELECTRIC TRANSFORMERS. R. Arno. May 17th.

13,418. REVERSE POWER ELECTRIC RELAYS. E. G. Waters. June 10th.

13,644. REFLECTORS. E. Weiner. June 12th. (December 28th, 1912).

13,715. ELECTRIC CLOCK (INDEPENDENT OR MASTER). J. G. Scott. June 13th. (Convention date not granted).

13,755. PRODUCTION OF HIGH-TENSION DISCHARGES. W. H. Wilson. June 13th. (Cognate Application, 20,937/13).

13,983. DYNAMO-ELECTRIC GENERATORS FOR IGNITING IN INTERNAL-COMBUSTION ENGINES. A. Schubert. June 17th.

14,043. OPERATING GEAR FOR ELECTRIC CONTROLLERS. Sandycroft, Ltd., and T. M. Dutton. June 17th.

14,521. NAVAL FIRE CONTROL. A. H. Pollen, and H. Isherwood. June 23rd.

14,614. NUMBER-DIAL FOR AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE SYSTEMS. Siemens Bros. & Co., and E. A. Petithory. June 24th.

15,074. ELECTRIC COUPLINGS OR CONNECTORS FOR LIGHTING FIXTURES. British Thomson-Houston Co. (General Electric Co.). June 30th.

15,607. ADJUSTABLE TELEPHONE ARMS. M. J. D. Carter. July 7th.

17,761. WATER-TIGHT ELECTRIC SWITCH-CONTROLLED WALL-SOCKETS. R. G. Tyler, E. H. Freeman, and F. G. Shrewsbury. August 2nd.

18,178. ELECTRIC MOTORS. H. A. Whiteside. August 9th. (August 10th, 1912).

19,706. ALARM AND INDICATOR ARRANGEMENTS FOR LAUNDRY WASHING-MACHINES AND THE LIKE. W. A. Lees. September 1st.

19,756. DEVICE FOR FACILITATING THE MOUNTING OF STEREO, ELECTRO, AND OTHER PRINTING PLATES. E. W. J. Barnett. September 1st.

22,850. CIRCUIT ARRANGEMENTS FOR AUTOMATIC TELEPHONE SYSTEMS. Siemens and Halske Akt. Ges. October 9th. (October 11th, 1912, Addition to 18,498/12).

13,478. ELECTRICAL SIGNALLING APPARATUS. G. Dearle. October 16th.

26,713. METAL FILAMENT ELECTRIC LAMPS. B. Gnann. November 20th. (September 1st, 1913).

29,447. APPARATUS SUITABLE FOR USE IN WIRELESS TELEGRAPHY AND TELEPHONY. J. Schiessler. December 20th. (October 16th, 1913).

29,799. MEANS FOR WARNING AN ENGINE-DRIVER OF HIS APPROACH TO A SIGNAL WHICH IS AT DANGER. J. Forrester. December 27th.

29,839. INSULATORS FOR USE ON ELECTRICAL CIRCUITS. T. V. Frankum. December 27th.

1914.

198. APPARATUS FOR THE CONTROL FROM A DISTANCE OF A NUMBER OF GUNS FROM A SINGLE TRANSMITTER. R. Girardelli. January 3rd. (January 16th, 1913).

743. ELECTRO-PLATING DEVICES. L. Schulte. January 10th.

1,982. REMOTE CONTROLLED ELECTRIC SWITCHES. G. W. Hart. January 26th.

2,025. HOLDER FOR THE FILAMENT OF ELECTRIC INCANDESCENT LAMPS. S. Bloch. January 26th.

3,171. METHOD OF PERIODICALLY MODIFYING HIGH-FREQUENCY ELECTRIC CURRENTS. E. Von Lepel. February 6th. (February 11th, 1913).

5,024. PORTABLE ELECTRIC LAMPS FOR ILLUMINATING HEATING CHAMBERS SUCH AS BAKERS' OVENS AND THE LIKE TO FACILITATE INSPECTION THEREOF. C. R. Ellinger. February 26th.

6,093. ELECTRIC BATHS. H. Aub. March 10th.

7,165. FITTINGS FOR ELECTRIC LAMPS. J. Lutley. March 21st.

8,185. CONSTRUCTION AND METHOD OF ARRANGING INDUCTION COILS FOR LOADING DUPLEXED DOUBLE OVERHEAD TELEPHONE LINES WORKED ON THE PUPIN SYSTEM. H B. M. Pleijel, and A. H. Olsson. March 31st. (May 9th, 1913).

9,960. ELECTRIC ARC LAMPS. Siemens Schuckertwerke Ges. April 22nd. (April 22nd, 1913).

10,683. INTERRUPTER FOR THE ELECTRIC IGNITION OF INTERNAL-COMBUSTION ENGINES. Robert Bosch (Firm of). April 30th. (August 1st, 1913).

British Trade with Morocco.—A Commercial Agency has been established in London named the BRITISH COMMERCIAL AGENCY FOR MOROCCO, LTD. (139, Cannon Street, E.C.), with the object of promoting the sale of British manufactures in the rapidly increasing markets of Morocco. It is shown by official returns that British trade with Moroco has been declining for some time past, while that of other foreign nations, notably France and Germany, has been increasing by rapid strides. It has been thought that this keen competition cannot be met better than by establishing on the spot an efficient organisation which will devote itself to pushing forward, in every possible channel, the sale of British manufactures.

Cotton Post Bags.—We have received from MESSRS. COOPER & ROBERTS, 3, Paul's Bakehouse Court, Godliman Street, E.C., a set of the standard sizes of Aman's patent sample cotton post bags with linen address labels attached. These are manufactured by Messrs. Rockliff Bros., Ltd., of Liverpool, for whom Messrs. Cooper & Roberts are sole London agents, and we believe that they will commend themselves to electrical and engineering firms who have small samples of an unbreakable nature to send through the post. Goods enclosed in the bags are less likely to get damaged by the Post Office stamping as the address label is clear of the bag; the labels are most securely fastened to the bags by Aman's patent process.

Electromagnetic Piano.—The *Times* correspondent in Paris reports that at a conversazione given by the French Society of Civil Engineers to visiting British engineers, a demonstration was given of a new invention of two Frenchmen, M. Maitre and M. Martin, a piano in which the notes are produced by the wires being set in vibration by an electromagnet instead of being struck by hammers. The mechanism is operated in the usual way by a keyboard, but instead of dying gradually away as they do with ordinary pianos, the notes maintain their volume as long as the key is pressed. The effect produced is similar to that of an organ, and makes of the piano an entirely new and different instrument.

Wire Lamp Patents.—According to the *Neue Freie Presse*, the Austrian Patent Office has declared the two patents of the Deutsche Gasgluhlicht A.G. (the Auer-Osram Co.) for spring holders and molybdenum holders, Nos. 34,107 and 44,438, to be invalid. This is the result of the proceedings which the Gasgluhlicht-Gesellschaft originally initiated against the Vienna firms of Job Kremenezky, makers of the Metallum lamp, and the Westinghouse Metallfaden Gluhlampenfabrik, which produces the Vertex lamp.